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Proceedings
of the
Mining and Metallurgical Society
of America

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Volume XIII
1920

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Published at the Office of the Secretary
115 Broadway, New York

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MINING AND METALLURGICAL SOCIETY OF AMERICA

INDEX TO VOLUME XIII

Bulletin Nos. 137-143

Page
Accounts 50
Account keeping in mining schools 16
Acquisition of foreign mineral supplies 108
Adams, Brooks 62
Addicks, Lawrence 84, 115, 125
Administration of mines 16
Administrative service of Government 142
Africa, ancient mines in 57
Aims of curriculum of students in mining 10
Alaska coal land laws 154
Aluminum, world's control of 105
Amendments, by-laws and rules 47
Amendments, constitution 52
American capital, timidity of 111
American engineers in China 150
American Mining Congress — representatives to meeting of 158
American Petroleum Institute 158, 163, 179
American Philosophical Society 85
American Smelting & Refining Co. 104
Anglo-Persian Oil Co. 99
Annual gold medal (see "Medal")
Annual meeting—Jan. 11, 1921 1, 44, 54
  notice of 181
Antimony, world's control of 102
Applied mechanics in mining schools 11
Apprentice system in engineering 11
Apprenticeship course, General Electric Co. 25
Arnold, Ralph 171, 175, 183
Auditor's report 52

Bain, H. Foster 146
Baker, Mr. 38
Ball, S. H. 114, 115, 119, 124
Ballot for officers, 1921 157
Ballots on referendum 132
Barbour, Percy E. 31
Berry, E. S. 158
Boston-Washington super-power investigation 142
Bound volumes 91, 137
British Colonies, copper resources 113
British Metal Corporation 103
Bureau of Foreign and Domestic Commerce 140, 147
Bureau of Mines, dedication of new building 1
Bureau of Mines, new mining code 138
Business depression, discounting of 82
Business phenomena, natural law for 80
By-laws, changes in 43, 47, 52

Calendar year and fiscal year 93
Canadian petroleum fields 175
Canby, R. C. 39
Capital and labor, relations of 86
Carnegie Foundation 27
Caucasus Montains, ancient mines in 57

Page
Chance, H. M. 84
Channing, J. Parke 199
Chia Shan copper mine 141
Church, J. A., Jr. 79, 95, 107
China, Commercial Handbook of 141
China, mineral resources of 109, 148
China, Japan's interest in 116
Chrome, committee on 92
Chromite, world's control of 102
Chuquicamata copper mine, development of 193
Cincinnati, University of 26
Classification and compensation of engineers 94, 144
Clements, J. M. 141, 147
Coal industry, control of 100
Coal land laws in Alaska 154
Coal Resources of the United States 100
Coal supplies of China 109
Coal trade of the United States 100
College training, foundation of 34
Columbia University 7
Commerce, the controlling factor in history 97
Commercial Handbook of China 141
Committee on chrome 92
Committee on economics 2, 45, 135, 144
Committee, Executive 43, 134
Committee on metals 47
Committee on military education 87
Committee, National Safety Code 131
Committee on post-graduate education 92
Committee on revision of mining laws 131
Committee on technical education 40
Communications 2, 135, 146, 199
Communism, original Marxian 58
Compensation of engineers 94, 144
Conference with mine labor leaders 157
Congressional action, securing of 118, 121, 123
Congress, bills before 1, 129, 130, 142, 199
Co-operation, industrial 2, 5
Co-ordination of labor and capital 63
Constitution and by-laws, alteration of 43, 52
Control of the world's mineral resources 95
Control of the world's petroleum 159
Copper Export Association 104
Copper market, control of 112
Copper production of the world 112
Copper resources, British Colonies 113
Copper resources, Formosa 113
Copper resources, Russia 113
Copper, United States control of, liable to be lost 108
Copper, world's control of 103
Corning, C. R. 33
Cost of living, high 4
Costs, mining 28, 29
Cottrell, F. G. 182
Council meetings 91, 129, 143, 157

Courses of study, practical, for mining engineers 15
Credits, exhaustion of European 3
Culture, significance of, to the engineer 55
Curriculum of mining schools 6, 10
Curtis bill, the 115, 119, 124, 130, 133

Dedication new building of Bureau of Mines 1
Degrees, meaning of 20
Degrees, standardization of, requirements for 20
Democracy, industrial 2, 62
Department of Public Works 92, 93, 94, 129, 141, 199
Department of Public Works, referendum on 131, 134
Descartes 56
Diplomacy, foreign vs. domestic 97
Diplomacy vs. legislation 121
Dollar wages 4
Domination of petroleum sources 160
Dorr, J. V. N. 184
Dues 49
Dufourcq, E. L. 49

Economic blindness of labor 2
Economics, committee on 2, 45, 135, 144
Economic conditions of Europe 168
Economic events of 1919, basic 3
Education, a campaign of public 127
Education, committee on 53
Education, engineering 6, 10, 15, 25, 26, 27, 45, 46, 48
Education, post-graduate 17, 46, 92
Employer and employees referendum 144
Engineering apprenticeship 11
Engineering Council 1, 93
Engineering education 6, 10, 15, 25, 26, 27, 45, 46, 48
Engineering, graduate work in 17
Engineers, compensation of 94, 144
Engineer in industry, the 1
Engineers, "ready-made" 12
Engineers, registration of 1
Engineer, significance of culture to the 55
Era of extravagance, domestic 3
European credits, exhaustion of 3
Europe, economic condition of 168
European foreign policies 96
Events of 1919, basic economic 3
Exchange favors foreign mining investments 110
Executive Committee of Council 43, 134
Extravagance, domestic era of 3

Far East, mineral resources of 147
Federal machinery, sluggishness of 123
Federal Reserve Board, the 3
Federated American Engineering Societies 127, 144, 157
Federated American Engineering Societies, referendum on 181
Finances of the Society 50
Foreign policy, A 155
Foreign mineral resources 106, 140, 147
Foreign mining favored by exchange 110
Foreign petroleum, our dependence upon 111
Foreign policies, European 96
Foreign policies, United States 96
Formal actions of Society 49, 119
Formosa, copper resources 113
Freeland, W. H. 151

Gemmell, R. C. 183
Geologists, value of to petroleum industry 176
General Electric Co. 18
Gold criteria 68
Gold deposits of Mexico 69
Gold industry, stimulation of 70, 77
Gold Medal (see "Medal")
Gold production, present status of 67, 92
Gold production:
    Africa 74
    Asia 73
    Australia 73
    Canada 72
    Mexico 72
    South America 73
    United States 70
Gold statistics 68
Gold, uses of 76
Gottsberger, B. B. 158
Graphite, world's control of 105
Graton, Louis C. 121
Guggenheim, H. F. 192

Holmes, Jos. A., Safety Assn. 139
Hoover, H. C. 16, 182
Humanization of Industry 63
Huntoon, L. D. 154

Illinois, University of 27
Imperial Statistical Conference 93
Income, wealth and 146
Indexes 91
Individualism 28, 59
Industrial co-operation 2, 5
Industrial democracy 2, 62
Industrial unrest, cause of 87
Industry, humanization of 63
Ingalls, W. R. 2, 21, 34, 35, 92, 151, 167, 182
International Chamber of Commerce 131, 163
International laws, reciprocal 146
Iron industry, control of 101
Iron ores of China 108

James, William 56
Japan, mineral resources 148
Japan's interest in China's minerals 116
Jensen, Capt. 112, 116
Joint committee on reorganization 142
Jones-Reavis Bill 93, 199

Kirby, E. B. 87
Knox, H. H. 116, 119, 124, 184
Knox, H. H., Presidential address 55
Knox, H. H., remarks by 53
Korea, tungsten resources of 148

Laboratories for teaching mining details 15
Labor and capital, relations of 63, 86
Labor, economic blindness of 2
Labor leaders, conference with 157
Laird, G. A. 155

Law (See "Mining Law")
Laws, international, reciprocal 146
Lead, world's control of 103
Ledoux, Dr. A. R. 169
Legislation affecting foreign mineral development 115
Lewis, Prof. J. Volney 36, 38, 40, 126
Lindgren, Prof. W. 183
Lindgren, Prof. Waldemar, addresses by 67, 195
Living, high cost of 4
Living, standard of 4

Mann, Prof. Charles R. 27
Manning, Dr. Van. H. 159
Mechanics, applied, in mining schools 11
Medal Committee report 91
Medal, rules respecting presentation 48
Medal presentation dinner 50
Medal of the Society, annual 143
Medal, 1920 43, 129, 130, 187
Medal, 1921 143
Meeting, annual 1, 44, 54, 181
Meetings of Council 91, 129, 143, 157
Meeting of Executive Committee 134
Meetings of Sections 6, 91, 95, 158
Meissner, Carl A. 31, 34, 38, 118
Membership 47, 48
Memory, training of 23
Men, management of 16
Mercury, committee on 92
Metals, committee on 47
Metals, the foundation of modern civilization 95
Metallgesellschaft, the 103
Mexican petroleum conditions 171
Mica, world's control of 105
Military education, committee on 87
Mine administration 16
Mine equipment, standardization of 158
Mine labor leaders, conference with 157
Mineral resources, China 109, 148
Mineral resources, control of the world's 95
Mineral resources, Far East 147
Mineral resources, foreign 147
Mineral resources, Japan 148
Mineral resources, United States 121
Mineral wealth, competition for 95
Mining code, new 137
Mining details, laboratories for teaching 15
Mining engineers and metallurgists, demand for 19
Mining and metallurgical students, number of 19
Mining laws, reciprocity in 131, 132
Mining laws, revision of 131, 137
Mining schools (see "Education")
Molybdenum, committee on 92
Molybdenum, world's control of 103
Monroe Doctrine 97, 112, 126
Monroe Doctrine of the East 102

National Chamber of Commerce 126, 131, 144
National crisis, the 58
National policies 120, 124, 127
National policies—tariff and Monroe Doctrine 126
National Public Works Department 92, 93, 94, 129, 141, 199
Natural law for business phenomena 80
National Safety Code Committee 131
New York Section meetings 6, 95, 158
New York Section, officers of 158
Nickel, world's control of 102
Nitrates, world's control of 106
North Atlantic Seaboard Survey 142

Objects of the Society 53
Observation, development of powers of 23
Occupational training 46
Oil (see also "Petroleum")
Oil entente, an 159
Oil industry, precarious position of 160
Oil resources, foreign domination of 160
Organization of mining schools 6

Peele, Prof. Robert 6, 29, 31, 34, 37
Penrose, R. A. F., Jr. 183
Petroleum 159
Petroleum conditions in Mexico 171
Petroleum, control of foreign resources 110
Petroleum, control of the world's supply 159
Petroleum, crisis in consumption of 160
Petroleum, dangers in the situation of 111
Petroleum development, foreign restrictions on 161
Petroleum development in the United States 161
Petroleum, encouragement of its production 163
Petroleum field of Trans-Caucasus 179
Petroleum, future supplies for the United States 161
Petroleum geologists 176
Petroleum in Canada 175
Petroleum interests abroad 164, 169
Petroleum, international aspect of 174
Petroleum legislation 115
Petroleum policy in foreign countries 166
Petroleum policy, suggested line of action 162, 166
Petroleum statistics, importance of 163
Phosphate rock, world's control of 105
Policies, American foreign 121
Policies, British foreign 122
Policy of the Society 53, 84
Policy of the United States respecting petroleum, suggestions 162, 164
Political and commercial control of the world's mineral resources 95
Post-graduate education 46
Post-graduate education, committee on 92
Potash, world's control of 106
Prosperity, fallacious notion about 3
Public interest in mineral development 119, 126
Public interest in national policies 127
Public Works Department 92, 93, 94, 129, 141, 199
Public Works Department Association 142
Pyritic smelting 151

Quicksilver, world's control of 105

Radium, conservation of 144
Rankin, Prof. 24
Reciprocal international laws 146
Reciprocity as to mineral development 110, 115
Recreation of a mining engineer 151
Referendum on Department of Public Works 131, 134
Referendum re employers and employees 144
Referendum on Federated American Engineering Societies 181
Referendum, reciprocity in mining laws 131
Referendum on Curtis Bill 130, 131
Referendum on resolution of committee on economics 45
Registration of engineers 1
Relations of labor to capital 86
Reorganization, Joint Committee on 142
Report of Committee on Economics 144
Report of Medal Committee 91
Report of Secretary, 1919 45
Report of tellers—annual meeting 44
Report of Treasurer 49
Resolution re reciprocity in mining laws 132
Restriction of petroleum development abroad 161
Restriction on investment of American capital abroad 99
Restrictions on investments of foreign capital in the United States 99
Restrictions on petroleum development in the United States 161
Revision of mining laws 131, 137
Rogers, Allen H. 26, 30, 35, 37, 40, 127, 182
Russia, copper resources 113, 117

Safety Association, Jos. A. Holmes 139
Safeguarding life, health and property 2
Secretary, report of 45
Section meetings 91, 95, 158
Schneider dinner committee 43
Schools, mining (see "Education")
Shui Kou Shan Mine (China) 148
Smelting, pyritic 151
Smith, E. A. C. 129
Smith, E. A. C., presentation of medal to 187, 197
Smoot-Reavis joint resolution 129
Smoot resolution 142
Social crisis, the 58
Socialism 58
Société Minerais et Metaux 103
South America, mineral resources of 112
Spurr, J. E. 95, 117
Standard of living 4
Standard of wages 4
Standardization of mine equipment 158
Statistical Conference, Imperial 93
Students, number of in mining and metallurgy 19
Studies, humanistic 42
Study, cultural 40
Sundry Civil Service bill 142
Super-Power investigation 142
Surveying, field practice in 7

Tacna-Arica controversy 97
Taxation, equality of 64
Tax on income earned abroad 156
Taxation, theory of 64
Technical education, committee on 40, 46
Tellers, report of 44
Tests, psychological 27
Tin, world's control of 104
Tchorok Valley 116
Trade commissioners 147
Trans-Caucasian petroleum fields 179
Treasurer's report 49
Tungsten resources of Korea 148
Tungsten, world's control of 102

United States Chamber of Commerce 126, 131, 144
University of Cincinnati 26
University of Illinois 27
Uranium, world's control of 103

Vanadium, world's control of 102
Vanderlip, F. A. 3

Wages, dollar 4
Wages, standard of 4
Walker, A. L. 188
Wealth and income 146
Westervelt, W. Y. 24, 29, 30, 34, 35, 38
White, Dr. David 107, 114, 115, 120, 125
Winchell, H. V. 131, 182
Worcester Polytechnic Institute 31
Work of Society 45
Work of Society for coming year 43

Zinc, world's control of 104

Mining and Metallurgical Society *of* America

Vol. XIII, No. 1 January, 1920 Bul. 137

ANNOUNCEMENTS.

Meetings of the Society.—The annual meeting of the Society was held on January 13th at the Columbia University Club, New York City. The afternoon session was attended by about one hundred and seventy-five members present in person or by proxy. Thirty-five members attended the evening session. A full report of both meetings appears in this BULLETIN.

New York Section.—A meeting of this Section was held in December which is reported in full in this BULLETIN. No meeting was held in January but one will be held in February. The subject for discussion will be announced later.

Bulletins.—Orders for the bound volume of the 1919 BULLETINS should be placed immediately. The Secretary has a few copies of the bound volumes of 1918 BULLETINS which may be secured on application.

Dedication of New Building of Bureau of Mines.—Mr. Robert Linton attended the dedication of the building, having been appointed by the President as a delegate to represent this Society.

In his report of the proceedings, Mr. Linton calls especial attention to the address delivered by Mr. J. P. Channing, "The Engineer in Industry" and earnestly urges that every engineer read this address. It was published in the November *Bulletin* of the American Institute of Mining and Metallurgical Engineers.

Registration of Engineers.—A committee appointed by Engineering Council has prepared and submitted to Council a model bill for discussion, with the suggestion that some such bill be adopted by all States. It is entitled "An act to regulate the practice of professional engineering, architecture and land surveying."

The object of the bill and registration is that of "safeguarding life, health and property" and it is provided that "any person practicing or offering to practice professional engineering, architecture or land surveying in this State, shall hereafter be required to submit evidence that he or she is qualified so to practice and shall be registered as hereinafter provided."

The report of the committee has been submitted to the Society, and consisting of twenty-seven typewritten pages, it is scarcely practicable to publish it in full. But little discussion is presented as to why this bill should have or should not have the support of mining engineers. Nevertheless they are included in its terms and should be vitally interested in seeing such a bill fail or become a law. If the support of mining engineers is desired it is rather unfortunate that the arguments in favor of the bill were not fully given, particularly those as to the advantages accruing to the profession of mining engineering and to the public. If mining engineers are to be registered if they would practice, whether they desire registration or not, it is a proper time for them to express themselves on the subject. It may be said in this connection that many mining engineers of Colorado, where such a law now exists, do not look upon it with favor.

Copies of the committee's report may be secured from Alfred D. Flinn, Secretary of Council.

COMMUNICATIONS.

The following communication has been received from W. R. Ingalls, Chairman, Committee on Economics:

Last January I delivered to the Society an address on the "Economic Duty of the Engineer." Later I presented to the Canadian Mining Institute a supplementary paper on "Industrial Co-operation." I think that by most of my hearers and readers my thoughts were understood, but by some they were not. While I did indeed scoff at what I characterized as the visionary and impracticable ideas about industrial democracy, I did not by any means uphold the old order of things and advocate a reactionary tendency. On the contrary I preached the crying need for economic advance and appealed especially to the generals of industry, and their engineering staffs, to develop better strategy in their conduct of affairs. I fear that too many people missed this essence of my thought. Although I deplored the economic blindness of labor, and pointed out what wonderful things it might do for itself if it only would see, I entertained no hopes that its eyes would be opened.

It will be useful now to review the economic events of 1919. They have been more outrageous and more preposterous than anybody a year ago would have ventured to prophesy. For this reason I think that the crisis in readjustment must be coming more quickly and more severely than was foreseen a year ago. The ideas that hard times could be averted, even that the world was entering upon a period of unparalleled prosperity, were always folderol. The world can not incur the losses of such a great war and become rich out of them. If it could there would well be staged something similar at regular intervals. It would not be necessary to kill anybody. Simply mobilize 25,000,000 men in Europe and let them go through maneuvers for three or four years. Anybody ought to see that that would be foolish.

The fallacious notion about prosperity has been fostered, consciously or unconsciously, by those scholars who have lectured that the gold we got from Europe and increased circulation of currency based upon it are responsible for the high prices for commodities and that high prices are therefore to be expected for many years to come. The Federal Reserve Board has repudiated that theory declaring that whatever expansion in currency we have had has been only in conformity with the requirements of trade, with which our currency automatically expands and contracts, and anybody acquainted with our present banking system knows that must be so.

The basic economic events of 1919 were the exhaustion of the remnants of European credits in this country and the development of a domestic era of extravagance. Underlying all, both abroad and at home, was the disinclination of people to work and the fallacious idea that they could live without working. Thus Europe instead of employing the remnants of her credit for tools and necessaries bought largely of luxuries and idled and wasted. America entered 1919 with a certain spirit of humility, and if that had been encouraged it might have ameliorated the adversity that is destined to come. However, that did not suit the plans of the majority of financiers. They inspired a sort of "sunshine" movement in order to sell motors and other luxury goods and encouraged the people to extravagance. The few, like Mr. Vanderlip, who foretold economic troubles and preached economy, became unpopular. The leaders who incited the boom of the spring and summer will have a good deal for which to answer. The people were not alone responsible. Now, the sober fact is that apart from some foodstuffs (with which we must supply Europe as well as ourselves) the production of commodities in this country has diminished during 1919. Even from 1916 to 1918 there was a diminishing tendency. It is not dollar, franc or ruble wages that make people comfortable. If it were the Russians would be the happiest people in the world. What the people need is goods—iron, wood and cement with which to build houses, coal to burn, wool and cotton for clothing, food to eat, etc. If we do not have so many pounds of those things per person now as we did in 1916, we can not as a whole be so comfortable as we were then. I think I am correct in saying that we do not have so many pounds. The reason that we have not, is that our workmen are not producing enough, and they are not producing enough for the reason that they are not working hard enough. The high cost of living is mainly the cost of high living, as James J. Hill once said: plus now the high cost of loafing.

It is not to be denied that many classes of people are living now better than ever before. Many have motor cars, and furs and diamonds who did not dream of them five years ago. But it must be self-evident that with a smaller supply of commodities available per person, if one class of working people get more of them than formerly, it must be mainly at the expense of other classes of working people. Although the money enabling this grasping of more than their share of goods by some people may be drawn from the rich in the form of taxes, the goods themselves are drawn from the rich only in slight degree, for the rich are relatively too few in number to consume any great quantity of goods in the aggregate. The rich man does not eat any more pounds of food than the poor man and he does not use many more pounds of wool, cotton and leather. And even in spite of taxes and in competition with the most extravagant of labor profiteers, he will still be able to satisfy his needs. Nothing can be clearer, I think, than the deduction that if the plumber, the printer, the brick-mason and others can have all the food, coal and clothing that they want, the factory worker and others must do with less.

The evil cycle started early in the war when high wages were bid to attract men to certain industries. At that time such wages had to be offered more generally in order to cajole workmen to produce, and many classes of labor came to conceive such wages as merely their due. Then followed the familiar chain of events. The workers in a certain industry finding their wages unequal to the cost of living demanded and obtained an increase. The local tradesmen immediately raised their rates and the workers were no better off than before. The tradesmen are charged with being profiteers and retort that their costs have gone up too. Perhaps they have, and for the reason that the workers producing their commodities, distributing them, etc., are somewhere slacking, loafing. It is well established that the railways are employing more men per ton-mile of freight than they did a few years ago. The outcome is obvious. First we have serious discomforts in transportation, and housing. Railway and tramway service is impaired. Cars are overcrowded partly for that reason and partly for greater demands upon them by persons who should be working but are now enjoying themselves. No matter how rich in money wages any class of laborers may be they can not buy any better train service than is available to all. Houses become scarce because of deficiency in building, which the high costs of material and labor have made too risky. Then commodities begin to be scarce, e. g., sugar, which becomes obtainable with difficulty even by the rich, coal supply becomes short and public buildings and homes become cold.

All talk about maintaining the standard of wages so as to maintain the standard of living is balderdash. The standard of living of the American people today is distinctly lower than it was before the war and it is going to deteriorate further. It might become as low as it is in Russia if we let production decline sufficiently. There is just one condition that would permit general loafing without harm. Assuming that the railways of the country require for their operation the work of 2,000,000 men for an average of 8 hours per day, if some improvement in methods would permit the operation by 1,000,000 men, the other million might loaf, or the entire 2,000,000 might work only four hours per day. Similarly with other industries. Some such progress, but not of the magnitude here indicated, is possible by what I mean by industrial cooperation, but it is not at present in sight.

Viewing the situation as it is, it may be written with assurance that the economic and industrial readjustment is not going to be on the upward course until the people of the world, and of this country, get to working hard and become reasonably happy in working. Every effort should be directed toward instilling this idea into the minds of everybody and dispelling all ideas about the importance of wages expressed in money. If the workers do not voluntarily adopt this policy, sooner or later, hunger and cold will compel them to do so. At the same time every extravagance in consumption should be firmly discouraged. It matters not whether anybody is able to buy luxuries and indulge in extravagances. He should refrain from doing so, and if he will not refrain, then severe consumption taxes should prevent him.

MEETINGS OF SECTIONS.

NEW YORK SECTION.

Meeting of December 18, 1919.

A meeting of the New York Section was held at the Columbia University Club on December 18, attended by thirty-five members and guests. The President of the Section, Mr. J. A. Church, Jr., introduced Professor Peele who addressed the meeting on the subject of Education of the Mining Engineer.

Prof. Peele.—Engineering education has been widely discussed in recent years by both teachers in technical schools and practicing engineers. Many papers on the subject have appeared in the engineering press and the transactions of societies; some dealing with the training required for entrance into the engineering schools, others with questions of curriculum, best methods of teaching, and the amount and kinds of practical instruction and laboratory work that should be provided in the schools. As might be expected, substantial unanimity of opinion prevails respecting the range of fundamental subjects of the first year or two of the school course. The debatable ground is chiefly the subject-matter and character of training in the later years, and to what extent it is feasible or desirable to include in the curriculum certain kinds of practical work, intended to shorten the young engineer's novitiate in his professional career. In opening the discussion at this time, it seems logical to begin by considering questions of curriculum, organization of and work done in mining schools, and the results obtained.

In most well organized engineering schools, the first year curriculum exhibits comparatively few variations of importance. In some schools, where several engineering courses are maintained, leading to different degrees, the first-year studies are identical for all the courses, whether civil, chemical, electrical, mechanical or mining engineering. Differentiation begins with the second year, the divergence increasing in the subsequent years. This plan is advantageous for all concerned, including the students themselves, since those who have entered the school with no decided bent are not obliged to make a final choice of their course of study until the beginning of the second year. Most of the mining schools of this country take the graduate of the high school or preparatory school, at the age of about 18, and give him four years of training, leading to the degree of mining or metallurgical engineer. There are several exceptions to this rule. Columbia University, for example, recently placed her group of engineering schools, including the School of Mines, upon a graduate basis. The length of the course is reduced from four to three years. Candidates for admission to this shortened course must have such preliminary general education as can ordinarily be obtained by at least three years' work in a college or scientific school of high rank. Time and opportunity are thus afforded for some of the cultural studies. One of the outstanding purposes is to train the student in the use of the English language. The immediate effect of this change is that most of the subjects formerly given in the first year of the four-year course are now included in the entrance requirements. Possessing a broader general education, the students are expected to do better work in the school and to make better engineers after graduation. Whether or not this expectation will be realized it is not yet possible to say; the new plan has been in operation too short a time, and the first class to enter under it began its work just at the outbreak of the Great War.

Referring more particularly to the usual four-year course in our mining schools, the greater part of the first two years is devoted to mathematics (through calculus), physics, mechanics, drafting, theory of surveying, general geology, mineralogy, chemistry (including qualitative and quantitative analysis, general and industrial chemistry), and the elements of electrical engineering.

The third year curriculum comprises economic geology and mineral deposits, petrography, optical mineralogy, assaying, graphical statics, resistence of materials, steam power machinery and boilers, steam engine tests, a continuation of electrical engineering, and some of the mining subjects—including general excavation of earth and rock, explosives, tunnel-ing, boring, shaft sinking, prospecting and the methods of developing and working mines.

In the fourth year are grouped the rest of the mining subjects, viz: mine engineering, mine plant, administration and accounts, mining laws, and ore dressing; the metallurgy of iron, steel, copper, lead, gold, silver and other metals; also thermodynamics, hydraulics, gas power machinery, geological surveys, and the graduating thesis or project. Roughly, the distinctively mining subjects occupy one-quarter to one-third the time of the third year, and one-half to two-thirds of the fourth year, including time given to laboratory work.

In the best organized and equipped schools, field practice in surveying occupies a total of about three months of the first two vacations; and at least two months of the last vacation are devoted to study, observation and note-taking in mines and metallurgical works, together with mine surveying and field geology. When properly directed, the summer field work in the mines forms a valuable part of the student's training. The students are not expected to run a drill, shovel ore, push a car, help to set timbers, nor to do any other mine work with their own hands. They are required instead to study systematically the details of all the underground and surface operations, taking full notes illustrated by dimensioned sketches. Thus, the students are not mere cursory on-lookers; because, to make detailed notes and sketches, they must study each operation and machine at close range and for a considerable time. They should remain in each assigned place (as a stope or drift) for a period of one to three shifts, depending on local conditions. Failure to insist upon repetition in observing and note-taking has sometimes cast discredit on this useful student work. The class is best divided into squads of two to four students. Large bodies of students assembled underground not only hinder the work of the miners, but tend also to carry with them the college atmosphere. This generally reacts unfavorably on the miners, and may arouse a feeling of antagonism. Small squads, on the contrary, are likely to have little difficulty in establishing cordial relations with the miners. It is desirable for the class to be accompanied by a responsible instructor from the mining school, who visits the squads at intervals each day and oversees their work. Besides this, it is our practice at Columbia to put in the hands of each student a printed outline of the work he is required to do, with suggestions as to its performance. It conduces to good work, especially if the note books are examined and criticized every evening by the instructor. In most cases, the first three or four weeks should be spent in one mine, so that the students can become fairly familiar with it; after which short visits of a few days each are made to several other mines, where different conditions and practice can be seen. A succession of brief visits to a large number of mines is unwise. The students have no time for detailed observation and note-taking, which alone can impress upon their minds what they see, and they end with confused and more or less useless notions of mining. Under these conditions the summer course is merely a "trip," as it is sometimes called by students and not serious work.

Schools situated in mining regions are popularly supposed to enjoy special advantages, in that their students are privileged to make frequent visits underground and may be said to live in a mining atmosphere. This is well and good, provided the students fully utilize their opportunities, by spending enough time at the mines and carrying on definite, systematic study. As a matter of fact, the teaching staffs of some of these schools do not insist on stated periods of serious underground study, from the engineering standpoint; and they are apt to over-emphasize the value of doing manual labor, in running a machine drill, laying track, or setting a stull. The attainment of such manual dexterity is not the chief function of this branch of student work, nor of prime importance in the training of an engineer. Furthermore, it is not always found that students of these schools enjoy a perennial welcome from the managements of the neighboring mines; they often resort to regions as distant as those visited by schools not so conveniently located.

A considerable part of the curriculum prescribed for mining engineering students consists of civil, mechanical and electrical engineering subjects. These studies, with their accompanying laboratory work, may be provided for in two ways, depending on whether the mining school stands alone as an independent institution, or forms a division of a larger organization, as a university or general technological institute. In the first case, the maintenance of adequately equipped departments of instruction for the different engineering subjects constitutes a difficult problem, because of the size of the requisite teaching staff, and the large first cost and running expenses of the numerous laboratories. It is hardly necessary to say that many mining schools of this class do not and cannot provide efficient instruction in the allied branches of engineering.

The young graduates of some of them may possibly be more of miners, but they are certainly less of mining engineers. In the second case, the school of mines is one member of a group of technical schools or departments, each of which has the teaching staff and equipment necessary for specializing in its own subjects. The mining students, therefore, have the advantage of receiving instruction in the civil. mechanical and electrical engineering subjects direct from the several departments. Summing up, the chief factors that have influenced the scope of the curriculum and the system of instruction in American mining schools are: *first,* the mode of organization and degree of development of the individual departments, all of which depend mainly on the financial resources; *second,* the location of the school, whether situated or not in a mining region; *third,* whether the school forms part of a university or other institution, having a large teaching staff and extensive equipment; *fourth,* the chosen field of the school, that is, whether the curriculum aims to comprise only the subjects most closely related to the operations of mining or affords a broader training, in which the fundamental sciences and engineering subjects are more emphasized, in preparation for, and relation to, the study of mine engineering.

On examining the list of studies prescribed in the best schools, one is struck by the extent of the field to be covered and the multiplicity of subjects. This condition has been brought about largely by the great development of mechanical and electrical engineering, and their ever widening applications in the operations of mines. Formerly, far more of the work in and about the mines was done by manual labor; the limited variety of mining and ore-dressing machinery then available made the equipment and operations of mines a much simpler matter than at present. Forty years ago, electric transmission of power was practically unknown, and even electric lighting was in a rudimentary state. At the same date, mechanical engineering was far less developed and specialized than now. Air compressors and machine drills were in their infancy, and nearly all mine pumping was done by Cornish pumps. Twenty years ago, the applications of oil and gas engines were few and unimportant. Until about 1910, thermo-dynamics was chiefly a theory, a bag of dry bones, annually shaken up to the dismay and confusion of the unfortunate student. Now, it is a useful tool of the engineer, in connection with steam, compressed air and internal combustion engines, and is readily applied by the student. The present-day chemical theories are hardly comprehended by those who received their technical training twenty years ago, or less, and who have had no occasion to study the new bases of the science. In further illustration of the great changes that have taken place, I may mention that, in the 13th edition of Rankine's famous textbook of civil engineering, that I used as a student in 1883, no mention whatever is made of steam shovels, nor of any other mechanical excavator, except a note of twenty lines regarding dredging.

In these circumstances, the limited scope of engineering training made it possible to confine the attention of the mining student to a much narrower field. More time might be given to chemistry, physics, geology, mineralogy, and their applications to mining, ore-dressing and metallurgy. Nevertheless, it is probable that the graduate of thirty-five or forty years ago had less grasp of the practical side of mining as a branch of engineering. Today, young men are in constant, though often unconscious, touch with the multitude of mechanical and electrical devices that play their part in our daily life, and they are inevitably brought into contact with engineering details of the most varied description; all of which tends to develop their knowledge of applied mechanics, using that term in its broadest sense. But, these very conditions have so enlarged the field of study that the customary four-year course is overcrowded in the endeavor to keep abreast of the times. If the student's work be done in haste and under a feeling of pressure, his mental vision tends to become obscured and his sense of proportion distorted. His deliberative faculties are stunted by living too much in an atmosphere of facts, for the assimilation and classification of which he has insufficient time. In dealing with some of the engineering subjects, the instructor may give undue prominence to descriptions of methods and appliances, the details of which vary as practice changes and advances, and too little to the principles on which practice is based. Teaching of facts is one of the lower functions of the instructor. If it be done without impressing upon the students the reasons for the existence of the facts and their relations to one another, the chief purpose of education is only partially fulfilled.

Formerly, the work of the engineer was accomplished mainly through the knowledge and skill attained by long periods of apprenticeship in practical construction, together with a limited acquaintance with mathematics, mensuration, elementary mechanics and the physical sciences. Before the day of technical schools, an apprentice system was in operation. The student of engineering began his training in an engineer's office, paying a fee for the privilege. He copied specifications and estimates, made tracings or copies of drawings, and served as assistant in different capacities, according to his fitness and abilities. In course of time, he learned the elements of his profession. Occasionally, the master engineer imparted knowledge directly, as a teacher, though this was not specifically stipulated in the indenture papers. The apprentice's progress depended chiefly on his own industry and ability, and the character and amount of the professional work passing through the office. Given an earnest, hard working boy, in the office of an able and conscientious engineer with a large practice, the apprentice system is at its best. But it is clear that such a mode of learning the practice of engineering was haphazard and wasteful of time, because it depended too much on the personal equations of master and pupil, and lacked the rivalry and stimulus of classroom work. Moreover, the apprentice was apt to become a rule-of-thumb practitioner, knowing only imperfectly the fundamentals of scientific engineering.

The modern school of mines also has its defects. Whatever the differences in physical and mental capability of the young men entering the school, all are held to the same routine and are driven through the course of study at the same speed. With large classes of students it is difficult to see how this could be avoided. Even if it were possible so to vary the system of training as to adapt it to each individual, there would still be some failures. In their mental characteristics, the students probably exhibit as great differences as exist amongst young men entering any other business or profession. Some choose the engineering course because they feel a genuine interest in it; others drift in, having no particular bent in any direction; a few enter against their wills, at the desire of their parents. During the first year or two, a weeding out process eliminates many of the poorer students. If this process is untrammelled, or actually assisted in its operation, the average quality of the graduates is improved. I believe it is the duty of a conscientious instructor occasionally to assume the responsibility of dissuading an ineffectual student from pursuing further a career for which he appears to be unfitted. This is a difficult and delicate function to perform, because, at the end of the first year, or even the second, the student may not yet have "found himself"; but there are cases in which wise and timely advice may be productive of good.

In considering the results of training in the mining schools, two important points must be kept in mind—viz.: the multiplicity of subjects demanding a place in the present-day curriculum, and the comparatively short period of time within which the school work must be compressed. In dealing with the situation there is a choice between two modes of procedure: first, to confine the course of study, or at least give special attention, to the subjects that appear to be most useful to the young engineer in the period immediately following graduation; or, second, to frame the curriculum in such manner as to insure a thorough grounding in the fundamental studies.

If the first type of training be adopted, the purely mining subjects will be emphasized; that is, those consisting chiefly of applications of the basic engineering studies. Recognizing the extent of the field covered by these applications, it is clear that, unless the course of study were unduly lengthened, the adoption of such a plan would involve serious neglect of the fundamentals themselves. In the effort to turn out "ready-made engineers," there would be insufficient time for a sound training in mathematics, physics, mechanics, chemistry, and the other physical sciences, upon which all engineering is based. These are the studies that do not change with the lapse of time or change only in non-essential details. And, if they are not mastered in the school, it is more than probable that they will never be mastered in after life. This is true at least in the case of the man of average ability. It is only the rare genius who, by the exercise of certain faculties not possessed by ordinary mortals, is able in later years to transcend the limitations imposed by defects of early education. Comparing the immediate results of these two types of training, we must conclude that, while the average graduate produced by the first type might make a good mine foreman in a very short time, he could not expect to go far as an engineer. The real question is not where the graduate will be professionally at the age of 22 or 23, but where he will be at 30. The course of study that insures a thorough drill in principles and in theoretical engineering subjects, develops scientific habits of thought, and furnishes a groundwork which will enable the student to make faster and better progress as an engineer, than he could make if, while devoting less time to these subjects, he has been led to dwell more on the changing details of practice. Such a training furnishes better tools for attacking each new problem as it presents itself, than that consisting of the accumulation of details of special applications. Many applications of physics and mechanics, for example, are too intricate in their details for the student to grasp, but he can and should be familiar with the general laws upon which they depend. Some may say that, in giving so much attention to the fundamentals, too little time is left to enable the student to discover and familiarize himself with the relationships of principles to engineering practice. The answer is that this part of the training is supplied, in a measure, by laboratory work. In most mining schools, the afternoons throughout the entire course of study are occupied by laboratory, drafting and design work, which illustrates the theoretical subjects as taught by lecture and recitation, and drives them home by showing how they are used in solving engineering problems.

In connection with courses of lectures, it should be made clear to the students that, in the case of most technical subjects, only the salient points can be touched on. No course of lectures on an applied engineering subject does or can cover the ground thoroughly in the alloted time. Collateral reading by the student is therefore important; but it must be admitted that the daily assigned work is so exacting that students find it difficult to do much outside reading during their undergraduate years. The best that can be done, as a rule, is to furnish references, from time to time during the lectures, to books, periodicals and papers bearing on the subject matter. Even if the students cannot look up these references immediately, they know where fuller information is to be found for future use. Some practicing engineers, as well as students, are apt to neglect the literature of their profession. They forget that engineering was not made yesterday, nor last week; but that it is being made today. I once met the chief engineer of a large iron mining company in the northwest, who was at work on plans for sinking a shaft through a considerable depth of soft, water-bearing ground. This was before such shafts were as common in the United States as they are now. In discussing the matter, I found that he thought he was dealing with a new problem, and expressed surprise when I told him that a number of methods of doing such work had long been in use in Europe, and where he could get information regarding some shafts that had already been sunk under similar conditions in this country.

The criticism is sometimes heard that the mining school graduate gets his start in the field at the expense of his first employers; that there is a gap between the end of the school training and a condition of reasonable efficiency and usefulness, which the school should endeavor to bridge over. Probably this view is held most often by employers who are not themselves technical graduates, though it is occasionally shared by older graduate engineers, upon whom may devolve the duty of imparting instruction to their young brothers in the field. As it is a question concerning which real differences of opinion exist, discussion may be useful. Since the graduates of technical schools are but the partly elaborated material from which engineers are made, it is clear that all of them cannot be equally efficient at the time they begin their field career. The personal equations of the young men must be taken into account, and the character of the training obtainable in different schools varies in scope and thoroughness. Moreover, as I have tried to show, it is impossible to find time in four or even in six years of study for dealing with all the increasingly numerous special engineering applications, without sacrificing thoroughness in the theoretical subjects. Perhaps it is too much to expect that the average mine manager or other employer of embryo engineers can realize the difficulty of reaching a wholly satisfactory solution of the problem. The occasional failure naturally bulks larger in his mind than many successes.

Several phases of the matter may be considered:

First—Granting a sincere attempt to make the course of study "more practical," in order to shorten or eliminate the post-graduate period of imperfect fruition, the wisdom of attempting to reproduce in the schools actual engineering or commercial conditions is questionable. As it can be done only imperfectly, the students are apt to get wrong or distorted ideas, and form an exaggerated opinion as to the value of their own attainments, all of which must be discarded after graduation. I believe that, in general, the laboratory equipment of mining schools should not be planned on a scale implying imitation of full working conditions, but be limited to apparatus and methods suitable in scope and design simply for laboratory use. Anything more than this is, with few exceptions, ill-advised and futile. In expressing this belief, I have in mind a school in the middle west, where laboratories have been established for teaching mining details. There is a laboratory for running machine drills, making comparative tests of the drilling speeds of different machines, sharpening and tempering drill steels, and testing the results obtained from different bits. Another laboratory consists of a tunnel and machine drill power plant, for carrying on drilling and blasting, and for studying the location of rounds of holes, and results from the use of different explosives. In this laboratory, the work of mucking, tracklaying and timbering is also studied.

A third laboratory is for the purpose of giving instruction in "mine rescue" and "first aid" methods and appliances. Similar laboratories for practical work have been added to one or two other western mining schools. All of these details are important, but, if enough time is given them in the school to make them of real use to the student, it is certain that the basic and much more important engineering studies must be curtailed or neglected. Again, would it be possible in the school to give the student a sufficient variety of "practical" work to enable him, at once after graduation, to meet his employer's demands in whatever line of duty he may be called on to serve? It is conceivable that the student could specialize in one or two directions, it is not conceivable that he could be prepared to fill immediately and equally well all of the beginners' positions usually open to the young graduate; that he could at once grapple successfully with the details of engineering problems. But, if he has had a sound training in the theoretical subjects, he can be readily broken into any particular line of work that may be required. What an employer wants above all in the young graduate is common sense and receptivity of mind.

In speaking of his own experience as a large employer of young engineers in the mines with which he has been connected, Mr. H. C. Hoover, once made the following statement:

> "What we desire are young men of good natural qualifications, thoroughly trained theoretically, without any so-called practical knowledge, unless the knowledge has been gained by employment in actual works; for, as expressed by one of the leading members of our staff, we have not the time nor inclination to knock out of the heads of these men misimpressions which they have gained by so-called practical training in the technical school."

The president of a large shoe manufacturing company said:

> "We don't want boys taught how to make shoes in a school. We can teach them better here at the factory. We want them educated by the schools. We want intelligent men, adaptable men. . . . ."

Second—Some engineers are of opinion that the mining schools should give more instruction in the details of mine administration and account-keeping. In well planned courses of study the elements of these subjects are already taught. But where can the details be so well learned as in a mine or metallurgical works, under a competent engineer or superintendent? The young engineer will there get the real thing, stimulated meanwhile by the consciousness of personal responsibility for his own failure or success. Instruction in the management of men has also been urged as a necessary part of the young engineer's training. This is indeed a most important matter for the superintendent, but it can hardly be held that the province of the school is to turn out ready-made superintendents. The understanding of men and success in managing them come from maturity and experience, not from books nor courses of lectures; they must be learned in the subordinate positions first occupied by the graduate, in which he is prepared for the higher and more responsible positions.

Third—The phrase "graduate work in engineering" is often heard in these days. The implication is that it is of an advanced character, undertaken in the technical school for the purpose of carrying the student further along in his preparation for field work. It may consist of research, or of specialized studies in engineering, following upon the regular curriculum. Some branches of engineering, like electrical and chemical engineering, are better adapted than others to specialization and research in the school, because they are based directly upon the fundamental sciences; and because the laboratory work that accompanies these studies is quite closely related in both nature and scope to field methods and practice. Mine engineering, on the contrary, consists largely of applications of the other engineering branches. It, therefore, does not furnish so profitable a field for research in the school. Another objection to this "graduate work" is that it unduly prolongs the period of preparation for active professional life. The student may become "stale." And, when he finally enters the field, he is less adaptable, and may possibly find himself loaded up with more things that must be unlearned than would have been the case if he had begun his field career earlier.

Fourth—The suggestion has been made that, if means were provided, a more or less extended period of post-graduate study and practice might be organized at some mine to be operated by the teaching staff and students of the mining school. Some years ago this plan was tried at a small mine, by one of the schools, but without success. Even under the most favorable conditions, the outcome would be dubious. Aside from the first cost, there are two serious objections: first, the work done in such a mine lacks the elements of reality and variety of conditions, so that the students' interest soon flags or is destroyed; second, nearly all young graduates want to get a position at once, and are restive under delay in making a real start in their professional careers. Moreover, it is impossible that a mine or metallurgical works operated as a school could be an economic success; and, failing in this, it would at best imperfectly fulfil the desired end. It is true that "apprentice schools" are satisfactorily maintained by some large engineering and manufacturing concerns, as for example that of the General Electric Co., but these schools are the works themselves, and not establishments conducted primarily for educational purposes.

Fifth—Some practicing engineers believe that a year or two spent immediately after graduation as actual workmen, on the different kinds of underground and surface work at a mine, constitutes the best post-graduate training. Many successful mining engineers have gone through this practical experience, but I am not sure, after having been brought into contact with a large number of young graduates, in the past twenty-five years or more, that such procedure is uniformly successful. Some who begin in this way become discouraged and give it up before going far enough to realize its possible benefits. Others, because of physical disability, fail to stand up to the work. Still others become restless and discontented, perhaps through the harmful influence of men of inferior character with whom they may be in daily contact; or, by association with workmen of extreme socialistic or anarchistic opinions, they may be infected by the mentally and morally debilitating doctrines so rife in recent years, and so led to abandon a sane, normal outlook on life. As a result, some of these young graduates give up mining for other occupations. On the other hand, those who possess the necessary physical and moral stamina are undoubtedly benefited by the period of post-graduate work and study.

It is unlikely that any considerable number of employers hold the view that young graduates of mining schools are, as a body, inefficient and unpractical. Facts prove the contrary. Positions are secured in nearly all cases immediately after graduation. The "practical" man is no longer sought after, as he once was. Most employers realize that, provided the young graduate is of reasonably good mental and physical quality, his training not only affords him the requisite knowledge to start him well in his profession, but has so developed his powers as to make him capable of promptly meeting the demands upon him. In most cases, he will advance and go further than the man of like native ability who has not had the advantage of a technical education.

That there are cases where the graduate's novitiate is unduly prolonged is undeniable. Not all men are equally well fitted by nature for an engineering career; nor do all schools afford an equally good training. In general, I believe the best results are secured, not by giving more time in the school to specialized work or study of details, but by insuring that the student is thoroughly drilled in the principles of the fundamental engineering subjects.

In connection with the subject generally, I have looked up a phase of the question and I'd like to say a few words with regard to what may be termed the excessive number of mining schools in this country. The list of institutions in the United States offering courses for the training of mining engineers is a long one. I have here a list which totals forty-three; thirty-six of these are departments or schools forming divisions of larger institutions, universities and others, and the remaining seven are separate and independent schools. By that I mean schools like the Colorado School of Mines or the Michigan College of Mines. If you will allow me a few minutes more, there are several remarks that I would like to make with this list of forty-three schools and departments as a text. It is unnecessary to say that among these schools and departments of mining there are great variations in organization and equipment. The number ranking as first-class does not exceed ten, and may perhaps be limited to seven or eight. At the present time, in the United States the total number of students of mining and metallurgy is roughly 2,500, nearly two-thirds of whom, or say 1,500, are in eight or ten schools.

The demand for mining engineers and metallurgists is a matter of interest to both students of mining and employers. Accurate statistics of the total number of practicing engineers are not available, but some idea of the number may be obtained from the membership rolls of the mining societies of the country. In October, 1919, the membership of the American Institute of Mining Engineers was 7,684, the membership of the Lake Superior Mining Institute 650; other local societies, in the coal regions and elsewhere, say 2,000; engineers who are not members of any mining society, say 3,000; total, in round numbers, 13,300. Deducting 800 for duplicates and members of the societies who are not engineers, leaves an estimated number of about 12,500. I have not considered the Mining and Metallurgical Society of America, as practically all its members belong also to the American Institute of Mining Engineers. Nor have I taken into account the large number of mine surveyors, assayers, etc., who are not technical graduates. To keep up the supply of engineers, about 1 in 30, or 420 new men, must be added to the ranks each year; of whom we may assume that 350 are technical graduates. On the basis of a four-year course of study, the 350 men per year could be graduated from the total student body of 1,500, which I have taken as the aggregate number in ten of the larger schools. Though the preceding figures are only approximate, it is clear that the requisite number of trained men could readily be maintained for some time to come by even six or eight strong institutions. That there are far too many mining schools in the United States can not be questioned. Many of them are poorly equipped, and, having inadequate teaching staffs, do not turn out well-trained men. Many others have but a handful of students. Some of these, in sparsely settled regions, have been established with the idea of meeting a local demand. Certain state universities have added mining departments to their group of schools, apparently more in response to a feeling of pride among citizens and state legislators, than from any conviction that the community needed or could fully utilize such educational facilities. The result of all this is unfortunate. There is great waste of money and energy in such a reduplication of schools. Since there is no common standard of attainment, the degrees conferred at different schools mean very different things. Often they imply no definite amount or kind of training. The situation is made even worse by the inevitable competition for students, which lowers the requirements for entrance, tends to laxity of discipline and injures the quality of student work. If it were possible to reduce the number of institutions to one-half or even one-third of those now existing, and then to standardize the requirements for the degrees of Mining Engineer or Metallurgical Engineer, both the students and the profession would be benefited. The members of the mining societies of the country can aid in influencing public opinion towards bringing about this desirable change, which will further the best interests of technical education and of the mining industry, and enhance the dignity of the profession.

The Chairman.—There can scarcely be a better way of testifying our appreciation of the very interesting paper that Prof. Peele has read than a thorough discussion. This Section, the New York Section, has an important function in the Society, one of supplying a forum for the discussion of subjects which may some time come up before the general society for an expression of opinion or for some kind of appropriate action, and our discussions are a valuable and necessary part of our evening's work. Mr. Ingalls, can you contribute something?

Mr. Ingalls.—Mr. Chairman, fellow members. I once had a discussion with a professor of metallurgy, who is the author of many famous books, upon how a real treatise on metallurgy should be written. He listened to me courteously, and after I had fully expressed myself he said, "Ingalls, what you have outlined would be exactly the right kind of a thing, but it would not do at all for the teacher. As a teacher I never would get across with it." I felt properly humbled and appreciated that the teacher has to consider, aside from the things that we think of, the most important thing of getting across with his ideas.

Having listened to Prof. Peele with great interest, I find myself in substantial agreement with what he has said. If anything, I think that my views of the subject are even broader than those he has outlined. Some years ago I was asked to talk to the mining students of the M. I. T., and after my talk, in which they appeared to have taken but little interest, they gathered around me and asked me what option I had taken when I was a student. "Option, option," I said, "what do you mean?" "Well," they replied, "we have reached the point in our mining course, where we have to make a choice between a mining option and a metallurgical option and perhaps something else; we should like to know out of curiosity what was your choice." I utterly failed to remember what had been my choice and I was forced to tell them that I did not remember. They expressed great surprise that so important an event in my career had entirely escaped my memory. I expressed proper mortification and, in extenuation of my lapse of memory said that I did not think it mattered much. At that they were even more surprised and asked, "What then shall we study?" I had been thinking a little during this conversation and replied, "My advice to you is to study your mathematics, your physics, chemistry, mineralogy, and other branches of pure science." As I talked to them in this way I saw that they manifested dissatisfaction with my advice, and seeing this I told them that I appreciated exactly how they felt, that when I was a student myself I did not like to go to mathematics and I liked less to go to physics. I did not object so much to chemistry, but applied mechanics I abhorred. I said that I preferred infinitely to potter around in the laboratory where I used to think that I was learning how to make chemical analyses and do other useful things. In the chemical laboratory we consulted Fresenius and worked an hour a day every week making precipitations and putting our analyses away on a shelf in a cabinet and the next day or the day but one after we continued the analysis. In the course of two or three months we had made a complete analysis of the compound. When I first went to work in the laboratory of a smelting works I learned that there were such things as making analysis of the principal elements of a slag in the course of thirty or forty minutes and that the chemist was expected to get his results in that time: "But," I said, "when you leave this institution the thing that is most immediately going to concern you is to find a job. Presuming that you have fitted yourself to be a mining engineer, and that there are not any mining engineering jobs or metallurgical engineering jobs available, you are considerably limited in your opportunities, whereas if you have grounded yourself very thoroughly in the pure sciences you are in a position to enter upon any kind of a job and much more quickly than a man who has not had your opportunities. Learn the details of the work into which you have entered and become an engineer or a chemist or a geologist as the case may be, none of which professional offices are you going to be able to fill immediately upon graduation. Moreover, as you get further along in your professional career you are going to be confronted with a great many problems of a kind that are not touched upon at all in the schools. You may, for example, be confronted with the problem of the transmission of natural gas or other gases at high pressure. You do not have any courses in your school on that subject you may not even be able to find text books on some of these particular subjects, but if you are well grounded in your pure science, in your mathematics, in your physics, your applied mechanics, you will be able to develop the formulae and the principles that will enable you to learn how to do such things and carry on."

I have heard such ideas expressed by other engineers of mature experience. Many years after this incident I happened to be at a dinner of my class, a class that was particularly rich in affording professors to our alma mater. Several of my classmates, who by that time had become full professors, were sitting near me at the table and among themselves they fell into a discussion of their courses of instruction and the burden of that talk was their inability to get into their courses all the many things that they would like to. One of these men, Prof. Miller, who is professor of steam engineering, deplored most vigorously his inability to get into his course what he thought should be there. Sitting near us was another of our classmates, who had from the day of his graduation been in the works as a mechanical engineer and had risen fairly high in the manufacturing business. He was a man whom we commonly viewed rather as a "roughneck" and the older he grew the rougher we thought his neck had become. When Prof. Miller had finished his talk this friend, who had been listening, spoke up and to the surprise of everybody made this remark: "Miller," he said, "there is nothing in your course that you could not profitably throw overboard and with benefit substitute a course in music." I think that I caught what he meant. He meant the importance, not only of thorough grounding in the fundamentals, but also the importance of broadening influences in the course of study of the engineering student.

Methods in all of our schools have improved vastly since my day. The young men of relatively recent years with whom I have come in contact have been in no way such tenderfeet as we were when we were turned out. On the contrary, they have impressed me rather as being well informed on technical points, but in spite of this I have observed among them a general lack of the broadening influences that are so desirable. The inability to express themselves in good English—I do not mean elegant English necessarily, but English of a character that may be precisely understood, which may be very simple English indeed. I have observed a general inability to read any foreign language, which has cut them off from a great deal of important literature and detracts often from their usefulness to their principal. I have observed, most important of all, the inability to concentrate in study. Too often is it that in spite of their course in the engineering and technical school they have failed utterly in learning how to study. I have observed, moreover, a great deficiency in training of the memory, and a great deficiency in the development of powers of observation. Those are things in which we all require training, things upon which special attention ought to be paid in the schools. When we are in the field, in the office, in all that we do we are very apt to have around us one man or a few men who can do things and it is upon them that we are always calling. One man distinguishes himself through the possession of an excellent memory, of knowing always what you have done, knowing where to go to find things. Those are the men upon whom we concentrate especially our attention and among the young men that we get from these schools we do not find enough of such. We want the men whom we know are going to be especially useful to us. Such a man as I have indicated was serving in the south of France. An organization in the north needed that man for some special work. They sent to the commanding officer in the south of France, asking for his transfer. The request was not immediately granted. It was followed by a further request: "Please let us have Captain Brown, he is the man that can do the things we need to have done. Please let us have the Captain. We will be glad to send two Majors in exchange."

The Chairman.—Mr. Ingalls' remarks recall an incident that happened in Mexico some years ago. There was a certain mine which was owned in Europe and received a certain proportion of its technical men from Europe. A hurry call was sent for an assayer. (The mine office made about eighty assays a day.) The European director sent an incumbent out to Mexico of his own choosing, writing in advance to say that this man never had made as much as one assay a day, but he thought he could do so in time. This man may have had a good equipment in some practical matter but he apparently lacked an entering wedge for the Mexican position. The first problem that a young graduate meets is that very problem of an entering wedge.

Mr. Westervelt.—Though I came to this meeting with a few points on which I had thought to speak, Professor Peele has brought out the most of them far more ably and clearly than can I, with possibly one exception. Mr. Ingalls has dwelt upon the others. This one exception, regarding the young graduate's necessity for an "entering wedge" has now been brought out by our Chairman in introducing me, and I now stand entirely bereft of any of the points which it had been my expectation to make.

Professor Peele has remarked on the tremendous growth in detail of engineering training, and this and his reference to Professor Rankin recalls a statement which I recently had from the son of one of Professor Rankin's classmates. It appears that Rankin, while an instructor or adjunct-professor, made two applications for professorships, one in civil engineering at the University of Glasgow and one in Greek at that or some other university. He rather preferred, I believe, to specialize in Greek, but he secured the civil engineering appointment, and the famous Rankin text books resulted! Fancy a man today, already an instructor or adjunct-professor in a University, who had not yet decided whether he was to go in for the classics or for civil engineering! Evidently it did not take a clever man long in those days to work up the technical details of civil engineering and we must recall that civil engineering at that time included all there then was of mechanical, electrical and mining engineering.

On the subject of technical education: I must admit I can speak only from the standpoint of the "man up a tree." The last personal contact I had with educational matters was the receipt of my diploma on graduation from Columbia School of Mines. From such a standpoint the emphasis is almost inevitably on what is desired as result rather than how to achieve the end sought. We all want young men trained to undertake our particular work and get good results therein. When we find a man lacking in the particular knowledge we need we are prone to find fault with the schools for not having taught him just the particular things we require. The impracticability of such an attitude however, has at various times been brought home to me and in recent years I have found it more satisfactory to proceed on the principle that a young man fresh from a school of engineering should not be expected to be more than reasonably well grounded in general engineering principles, to know how to start to work on an instrumental survey or in a metallurgical laboratory and to be alert minded and eager to learn the technical details of an engineering business. I must admit that this attitude has produced some ludicrous results, and I shall never forget the expression of countenance of a young fellow from a school from which he was about to graduate sent to apply for a position in a highly specialized industry. "What will I be expected to know?" he asked. "Nothing," I replied and he literally collapsed in his chair. He apparently was wondering for what his father had spent $5,000 or $10,000 on his education. I proceeded to explain to him that I was considering his application for the position because of the technical training he was about to complete and that I counted on it to have grounded him in general engineering principles and to have taught him how to quickly learn a new business. Apparently he could not grasp my meaning for he left without making a definite application for the position.

On the other hand, with the idea that industries either do or should employ young men from philanthropic motives to develop engineering talent in the country, I have little sympathy. Take for example, the apprenticeship course of the General Electric Company—one of the best things of its kind in the country, I understand. I had a young friend who took this course and having subsequently had an additional two years in one of our engineering schools, he is today filling a responsible position in mechanical engineering. The General Electric Company have organized their apprenticeship course in such a way as to get value from their apprentices from the very start, and I do not see why it is not always possible to so organize introductory work on which young graduates are placed. In fact, the fundamental theory on which the new University of Cincinnati engineering training is based as I understand it, is that not only a technical graduate but a technical student is entirely capable of doing remunerative work in engineering.

To sum up: It seems to me that the principal thing that any technical school should accomplish is a thorough grounding in the fundamentals of engineering. The pure sciences in so far as they are likely to have bearing on subsequent engineering experience, knowledge of the methods and objects of research, habits of observation and study, etc., all can best be learned in the school. A grounding in laboratory methods and the handling in the field of scientific apparatus, such as surveying instruments, can also be readily gained in the schools and, as Mr. Church has brought out, facility in these lines forms one of the best entering wedges in the business of engineering. Enough practical illustrations to establish in the mind of the student some connection between the fundamental principles he is studying and the every day needs of the engineer, I realize might also be added to the school courses but the advantage of anything beyond this being attempted in the schools, I must admit that I find myself seriously questioning. Give the boy the fundamentals of engineering in the schools, give him as good an opening in the business of engineering as fate will admit, and it seems to me it is largely the personal qualities the boy has inherited from his ancestors and his own development of character which determine his success and utility in the engineering world.

The Chairman.—There was a general committee appointed by the president charged with the very problem we have before us tonight and we have the good fortune to have the Chairman of the committee at the table. He has promised to make an informal report of the committee's activities and to indicate the line of thought which it has followed or purposes to follow.

Mr. Rogers.—Mr. Chairman, fellow members. When Mr. Knox wrote to me, asking me to undertake the chairmanship of this committee, he said it was very generally recognized that the schools of mining engineering were not turning out a product that was satisfactory to the practising engineer. This fact has been recognized for a great many years. I think as much as ten years ago the national societies appointed a joint committee to investigate technical education. They found the task considerably more than they had bargained for and they applied to the Carnegie Foundation for assistance, suggesting that an appropriation be made and someone be delegated under pay to investigate the whole thing and make a report. The man appointed was Prof. Charles R. Mann of the University of Illinois, and he spent a long time on the work, probably two years or more. His report as published by the Carnegie Foundation is certainly a magnificent thing. Any of you who are interested in the subject and have not read that report should certainly do so. He makes all the points that have been brought forward here. His opinion is that the technical student or the student who is studying engineering should be thoroughly grounded in the fundamental sciences. He also believes that more endeavor should be made to show the application of those fundamental sciences, and goes on to cite instances in support of his view. He speaks of one work on mathematics where, if I remember the figures rightly, out of some 2200 problems there are but 114 that deal with practical matters. He gives other examples. He describes what work is being done to correct this condition, and also to co-ordinate the cultural studies with the technical work, such as, for example, the cooperation of the department of English with the more technical departments in examining and criticizing the papers that are written in the course of technical work. In turning out any product, it is very important that good material be used, and a very large part of his report is taken up with the discussion of methods of determining, among a lot of candidates for entrance to an engineering school, the proper boys to admit. Several methods are described, among others a series of what might be called psychological tests, such as were used in the Army with great success.

The problem, therefore, is a pretty large one; it is a good deal larger than I had any idea it was when I went into it. Our committee is composed besides myself of Mr. Harry A. Guess, who is general superintendent of the mining operations of the American Smelting & Refining Company and employs a great many recent graduates. The other member is Prof. Graton, who, as you all know, is Professor of Economic Geology at Harvard when he is not serving the Government. Our problem, as I see it, consists, first, in trying to formulate or suggest some means by which students admitted, the boys admitted, may be better adapted for the pursuit of engineering. In that connection, Prof. Mann says the mortality at present is about 60%; in other words, sixty out of a hundred who enter, leave school before finishing, principally in the first year. Second, to recommend some way to coordinate the study of the fundamental sciences to a greater degree with practice. It does not seem to me that there is any reason why in the study of mathematics the practical example should not be used for practice as well as the purely imaginary one. In mathematics, in physics, or in chemistry, problems which arise every day in engineering practise can be used to show the student the practical value of what he is studying, thus stimulating his interest.

There is a further criticism that nobody has voiced here to-night and which seems to me well founded, and that is that in the study of engineering there is no consideration given to the practical question of costs. An engineering operation is certainly not worth while if it costs more than it is worth. Whether purely laboratory methods are capable of indicating this I cannot say at the present time, but it certainly seems as though some emphasis should be laid on this feature. Mining engineering covers problems in all branches of engineering, and it is perhaps the most difficult curriculum of any of the engineering courses to lay out. On the one hand, no one can question the desirability of giving as much information regarding practice as possible. On the other hand, we all agree that the theoretical bases of the science of engineering are absolutely necessary. The question of division of time, therefore, between all these different branches is very important. I would be very glad if anybody has any ideas on any of the phases of the problem if they would communicate with me.

The Chairman.—The speaker this evening has stressed on the one point of cultural training, some training in what we are accustomed to denominate as academic study as opposed to scientific study in conjunction with that scientific study itself. My alma mater has gone to the extent of making the course in mining engineering a post-graduate course, requiring, I believe, an A. B. degree, or training corresponding to that degree.

I do not know whether the system has been in effect long enough to give anything in the way of practical results, but

I should like to ask if that system applied at Columbia or elsewhere has shown anything that can be criticized favorably or otherwise by the members of the Section, and especially I should like to ask Prof. Peele if he has anything to say on the subject.

Prof. Peele.—I made merely a passing remark to the effect of the establishment of this post-graduate course. All I can add is the mere statement that it is in operation. The first class to enter under the new schedule was in 1914, the opening year of the war, and an entire change has therefore been going on during the progress of the war and any results which we could have obtained have been so influenced by the abnormal conditions that I hardly think that there is any member of the corps of instructors in the engineering schools of Columbia who feels in a position to make a definite statement as to whether they think it is going to be a success or not, far less to say anything definite as to the quality of the student body that will be graduated under this new regime. I greatly regret that circumstances are such that absolutely no data is available from which you might draw a conclusion

The Chairman.—There is one point in what Mr. Rogers had to say that struck me rather forcibly, and that is his reference to the study of or the realization of the importance of costs. I do not know the practice in other mining schools, but in Columbia the gentleman on my right (Prof. Peele) gives each student a thesis subject in his last year which is really an intensive study of mining costs. Personally I got more out of my thesis than I got out of anything else that I studied or out of anything that I did for the five or six years immediately following my graduation. It seems to me that this is one of the most important points that has been brought out in our discussion and I should like to know if it is the practice of the majority of schools to call for such an intensive study in the course of the regular curriculum.

Mr. Westervelt.—Mr. Chairman, I do not know whether Prof. Peele followed this movement. It started in the neighborhood of Cincinnati, not in mining schools but in other engineering schools, in which definite hours are given for a man to take a position and work along the lines of his course. It is work for which he gets paid. His study and his practical work go hand in hand.

Prof. Peele.—I referred to one college in the Middle West where they have laboratories and occupy considerable of the time in two of the years in doing that work, but not, of course, for pay. I should doubt very much whether it would be possible for a man to get what they all seem to think is so important, that is, a good sound training in the fundamentals, if he is going to spend much time in the practical work that is based on those fundamentals, especially if he is expected to earn some money from the actual doing of that work.

Mr. Westervelt.—My understanding is that the time was sufficiently extended so that the men could get actually as many hours as formerly on theoretical work before they got their degree.

Mr. Rogers.—I think the Cincinnati school has arranged so that the boys work two weeks in some of the shops around Cincinnati and then the following two weeks go to school. In that way there is always a crew in the shops, the other crew being in school. The boys are paid certain wages for the work they do. The first laboratory shop that was organized as a practical, commercial operation, was the Worcester Polytechnic. There a shop was equipped and twenty regular mechanics were hired to work constantly in the shop, the students working with them and learning from them. The University of Illinois also has a very large shop where gas engines are made, I believe. Generally speaking, in metal work the shop work consisted in learning fundamental operations, such as chipping, filing, forging, etc., with, however, no view of turning out a finished, marketable product.

The Chairman.—Mr. Rogers, do the students in those shops matriculate for engineering degrees in Illinois?

Mr. Rogers.—Oh, yes, and in the University of Cincinnati also. The University of Cincinnati is a comparatively new institution. It is organized on quite radically different lines from all other institutions. The general method for the formulation of a curriculum is for the Faculty to get together and decide how much time is to be allowed for each subject and leave entirely to that department the details of the work that such department gives during the time assigned to it. At the University of Cincinnati, the time allotted to and work given by each department is discussed by all the Faculty, giving particular attention to the relation and effect of the work of one department on that of the others. As a result, problems in steam engineering involving the use of mathematics are submitted to the mathematics department as well as to the steam engineering department. There is thus a co-operation which does not seem to be found in most schools. There are a great many radical ideas being tried out in the University of Cincinnati, but no mining, as such, is being taught there, although they have a course in metallurgical engineering.

Prof. Peele.—Mr. Rogers spoke of the mode of training in the University of Cincinnati. It occurred to me in connection with the point that I tried to bring out a little earlier, that this type of training is much more practicable and better applicable to the courses in mechanical and electrical engineering than would be possible in a mining engineering course.

Mr. Barbour.—I might say in reference to the shops of the Worcester Polytechnic, which happens to be my alma mater, that they started as a commercial workshop, building commercial material in a small way. The commercial end developed very rapidly. There was developed there, for instance, the plunger elevator which has been such a success. The students were required to work alongside of the workmen making all of the intricate valve mechanisms, etc. Eventually the elevator business became so large that they had to take it away from the college. It is now one of the thriving industries of Worcester. They also built grinders and this also developed to such an extent that it outgrew the shop. In my time at Tech., we built a great many machines which were exported. The bulk of the student's shopwork was done during his freshman and sophomore years. During his junior and senior years he only went into the shop to study the manufacturing costs and the analyses of those costs. All of the shop work, however, was a very small part of his curriculum. It worked out very well there in the course of mechanical engineering.

Mr. Meissner.—Mr. Chairman, there was one point that was brought out in one of the remarks made by Mr. Westervelt that interested me somewhat. He said that after all it depends a little on the boy's ancestry. I think this could be put a little bit more definitely. It depends a great deal on the interest that the boy's father or parents take in him, and it has sometimes occurred to me that if it were possible for the college to get in touch with the parents of such boys as are not getting along very well, and have the influence of the parents back the influence of the college, provided this influence is really interested or can be made interested (I think with the average college boy that can be done), it would have a very marked and material effect. I have noticed this in a number of cases. Perhaps I am at liberty, without being misunderstood, to apply it somewhat to myself. I have had four boys put through college. All four of them are at work, all four of them are successfully at work. They have followed out very largely the general principles that have been laid down by Prof. Peele and in the work that they have gone through they have not done much of the detail work that has been spoken of; they have gone through a general college education, which, I think, has fitted them for their work. I can speak of other boys whom I know; their courses have fitted them for almost anything within reasonable limits of their line and that is one point that Prof. Peele has brought out. You can go too much into specializing. You can follow up too much the present methods, but you have to teach them in the first place to study and in the second place to know where to get the information that they want. You must teach them to think. You can not begin to teach them specialties. I have often heard the remark made that the boys would come out all right. Well, they don't know anything particularly about a steel plant when they come out; they are not supposed to. One of my boys started in civil engineering, went through the ore mines and then went into blast furnace operation and studied the scientific use of coke. You might say that he had drifted away from civil engineering; that may be, but he and others I know have learned to study. They have their fundamentals and that is about all a college course can give and that is about all that the post-graduate course at Columbia will be able to give. It will probably give a boy a chance to specialize a little more than he can at present, but otherwise it will give him a more general education than heretofore.

The whole system of industry has become much more complex than it used to be in our day, as Mr. Ingalls said, and he is quite correct. We had much less to know, much less to do than the boys have today, the situation has become much more complex. I cannot quite agree with the statements that have been made as to the general education of the boys not being very good. I have found very little trouble on the question of English in the boys with whom I have had to deal, and with their lack of knowledge of one or two extra languages, they have at least possessed a reading knowledge. This may be a question of conditions. Some may strike boys who are poorly prepared, others not. We have not found that to be the case in our lines. As to getting them out to work after they come from college and teaching them that they must get a job and that they must earn a living, I think that we have had the best plan for them. We require them to go right straight through the works and do the manual work. These young men start in as one of my boys did next to a Hunkie. I have another boy who is working now as a helper in the machine shops, intending to go through the different departments. He has with him in those shops six or seven other college boys, all doing the same thing. He is exactly on a par in certain ways with the ordinary machinist, but it is recognized that he is going beyond them because he has had his education, and this is going to be a strong factor in the making of the man. He will go through much faster. He does not intend to stay a machinist. When you go a step further and take up the question of that six-year course, I think that this is going to be successful. Prof. Peele shows that there is not in mining engineering a very large number of men. I was surprised at the small number of men that he mentioned. There is a chance, to my mind, of getting enough men out of the multitude of boys that go into college who are willing to take the extra course, provided they are able to stand the expense, and the expense, to my mind, is the only objection. There will be enough who will want to take the larger course to take special pains in order to carry through the work that will put them a little above the average, and with the numbers that Prof. Peele mentions I cannot see why that cannot be accomplished. Again comes to my mind the question of expense. Can the boys stand it? Can the college stand it to have so very few as against the larger number?

The Chairman.—Following along the line of thought suggested by a discussion of human material, it may be of interest to mention the statement of at least one psychologist, that the human individual does his hardest work beween the ages of two and seven, and I think we may take as a corollary of that statement that between those ages he is most impressionable and most plastic. The faculty of the university or the technical school does not get its human material in the most plastic stage, it receives that material after it has been moulded and to some extent hardened by the preparatory school training.

I received an interesting letter from Mr. Corning on the general subject of the evening, in which he brings out that point:

"I am sorry that I shall probably be unable to attend the meeting of the New York Section tomorrow.

"The subject of Professor Peele's address is a question I have in the past sometimes discussed with him. In many cases the underlying foundation for college training is apparently lacking, although of course there are establishments where the preliminary training is, most likely, as good as can be desired.

"When I look back on my own experience—that of being educated entirely in public schools abroad and in Switzerland—and see and talk with young men who are entering college here and also with many who have left college, I am impressed by the fact that so many are totally unable to use their minds in such a way as to think independently and draw definite conclusions for themselves. If this conclusion holds, as I think it does, in many cases, there is little use in endeavoring to build a sound college superstructure on an unstable and inadequate foundation.

"The main hope for a remedy lies in awakening the body politic to the proper education for the embryo citizen.

"It seems unjustified and in many cases almost criminal that private individuals or groups should be allowed, as so often is the case, to take dozens of children either on the plea of charity or of educational experimentation and train them or not, as the fact may be, and then turn them loose in life to shift for themselves.

"If I might make a general suggestion, I believe it would be worth while to inquire of such members or men in the profession, who have had European training, concerning the methods of schooling and the results aimed at abroad. A comparison could then be made with the situation here and some knowledge secured concerning the best plans to remedy the evil."

Mr. Westervelt.—Mr. Chairman, I think one of my remarks might have given a wrong impression. I did not wish to give it as my opinion that heredity was the main consideration in the production of an engineer. I was only suggesting that, after all, we cannot arrange the schools to suit the training of all boys. If a man has not got it in him he will not get there.

Mr. Meissner.—The only point I want to bring out is that the boy who gets the backing of his parents regardless of his ancestry always has a better chance than the boy who has no such backing.

Mr. Ingalls.—I suppose, Prof. Peele, that educators are pretty much in agreement that the real basic trouble is with the primary and grammar schools?

Prof. Peele.—That is true—insufficient or ill-directed primary education.

Mr. Ingalls.—Why is that?

Prof. Peele.—I think it is because primary and secondary schools have shown such a tendency of late years to indulge in fads.

Mr. Rogers.—Surely the home has more influence than the schools. At the time Prof. Mann was making his investigation we all received a memorandum from him listing ten qualifications, character, efficiency, technical training, etc. 90% of the replies from engineers placed character as No. 1, while technical training was down around eighth or ninth.

Mr. Ingalls.—I have been following children in their course through the primary and grammar schools and I have been struck with the utter wearisomeness of the things that they go through in their studies in arithmetic and in English grammar and geography. I find them wrestling with a course in English grammar. I could not take an examination of a twelve-year old child in grammar and answer the questions and get a mark of more than 23.

Mr. Rogers.—That is because you do not know the technical terms, you have forgotten them, but you know how to write English.

Mr. Ingalls.—I think you have hit upon the trouble. They are taught in grammar and similarly in arithmetic as if they were playing a game. The chief function of the school seems to be, not to teach them the good use of the language, not to teach them any use of arithmetic, but to teach them a particular set of rules and to play the game that the teachers are playing with them, and soon after their course in school is finished they forget these.

Mr. Rogers.—That is entirely a parallel of the criticism that I was speaking of in that course in mathematics; out of 2200 examples it gave 414 of actual practice.

Mr. Ingalls.—I read of some school where the teacher threw away the arithmetic and got the boys interested in figuring baseball averages. He was very successful with that class.

Mr. Westervelt.—There is much in modern education that aims to show exactly that psychologic principle, that you must first arouse the interest before you can impart the information, but the trouble is that it takes a very clever woman or man to throw away the text book and use their own resources. Much of the teaching is done by those who can only hand out what is handed to them.

Prof. Lewis.—Mr. Chairman, it has been my privilege for many years to take a minor role in the course given to engineers, not mining engineers but civil engineers, mechanical engineers, electrical engineers, and to those specializing in chemistry but eventually passing on to chemical engineering. It seems to me the problems are very much the same all along the line. There is only one thought that comes out of my experience as a teacher that has been touched on tonight which I think is worth while emphasizing just a little further, the ability to think, the lack rather of the ability to think independently and to draw conclusions with confidence, with surety, with some degree of accuracy. That criticism applies in every walk of life. It is the exceptional person who can think. The great mass of people cannot think. Most of us just live a rule of thumb life. We move along the groove we have been placed in and we do as other people do. It is the exceptional man who thinks. In earlier days it was that exceptional man to a very large extent who made up the bulk of college students. In latter times it has become more fashionable to go to college and there are a great number of people who are coming in out of the larger other class. They come to college not so much for what they get out of college but for what they get out of the college life—social, athletic—but I think to a very large extent the dilution of our college student body in recent years by that large element who were not normally, under former conditions, college material at all, are responsible for the quality turned out by colleges in the recent years.

In all of these schools where a man must have some ability of independent thought and initiative, it is the duty of the institution to find out which of the men have the capacity to become thinkers. It should be a part of their admission, and I think this post-graduate arrangement has great promise in that respect. We are going to have a chance of weeding out at an early stage a great deal of lost motion and expense and labor,—weeding out the undesirables, the unfit, the men who never could be engineers no matter what they did, and keeping in the men who have the capacity, who have the ability, who have some ability to think, to take the initiative, to do things, and develop out of them the men who are to be the engineers. Only these would be successful anyway, so it seems to me the crux of the whole thing in any class of engineering or technical education or education requiring ability to meet situations arising from emergencies, to overcome obstacles that engineers in every line are constantly facing, is to find the man who has the ability, to cultivate that and teach him to use his mind. I think we could do no more for the engineering profession than to see that we are concentrating on the men worth while. Most of the trouble comes from this great mass of the people who cannot think.

I do not think that I can suggest anything at all as to what the engineering school should be, but I think that one of its prime objects should be that of sifting out and sending along through the course and out into the profession men who have the ability to make good engineers, and they will make good engineers all the more easily if we can eliminate from the class in the early stages the others who lack that ability and who could never by any process be made into real engineers.

Prof. Peele.—That question of elimination I could not help thinking of as applying to my own class in the school of mines a great many years ago. First and last there were 125 men in the class; the class graduated 34 out of a total of 125.

Mr. Rogers.—Was anything ever done at Columbia with those tests I spoke of, Prof. Peele?

Prof. Peele.—Yes, they were put in operation last fall. They are applied as well as the ordinary entrance examinations. They do not take the place of the examinations but run along with them.

Mr. Rogers.—One of the points that Prof. Mann makes in connection with these tests is the method of giving them. In each subject there will be a certain number of problems or questions, five or six, I think, of graded difficulty. The first will be so easy that anyone can do it, the next will be a little more difficult, the last will be so difficult that only the most capable student can answer. General problems are given that can be solved in a very short time if the student knows how, the object being to test his general intelligence. Others aim to determine whether the student has any bent for mechanical pursuits. A certain limited time is given to answer the questions and every problem must be solved before proceeding to the next. Thus the grading is automatic, that is, if a man answers three out of five, his grade is automatically 60%. The great point is made by Prof. Mann that the method of grading now in use varied a great deal among different schools and even among different instructors in the same school. That a man would grade 70% in one school doesn't necessarily mean that he would grade 70% in another school. In fact, between different departments the same difference might exist, so much depends on the personal equation of the man who does the grading.

Mr. Baker.—I am only a visitor here, but I cannot help bringing out one little point that was suggested to me by the last speaker. He stresses the ability to think. Now, there is a little phrase in the Bible that I happen to remember. It is, "Who by thought alone can add one cubit to his stature?" What do you mean by thinking? Pure logic, the pure ability to reason? If you mean that, that can be taught by a vast variety or different types of study, not only engineering but legal and other kinds.

My own experience, and I think a great many people will agree with me, has been that the college graduate possesses a great ability to think but very little capacity to observe and that the tendency of the training, particularly the training along broad scientific lines, where a man is taught to absorb a great deal of theory, to deduce many equations and do a great deal of analytical work, is to make that man introspective and that he does not observe, he does not see things, and that is a very general failing of the young graduate. He may not lack the faculty but the cultivation of the powers of observation has not been brought out, and it seems to me it is well worth mentioning.

The Chairman.—In trying to define thinking, the power of thinking from an intelligent standpoint, are we not dealing with good judgment in the selection of a sound premise from which the engineer can proceed by correct logic to a conclusion? The idea of observation would then come in the choice of premise.

Prof. Lewis.—Criticism of college work is that there is too much inductive reasoning and not enough deductive.

Mr. Meissner.—Most of the college boys we run across are a very wide-awake, observing bunch. They notice things extremely quickly. My experience has been that most of the college boys that we have had are quick to see things and then are very quick to learn because they have seen.

Mr. Westervelt.—The question of elimination, discouraging boys, trying to get them stopped, while a very good idea, has very distinct limits. I remember a very amusing instance which came under my notice a few years ago. I was serving on an educational matter with a prominent lawyer and a prominent architect. We were reminiscing of college experiences and the architect said, "Well, good old Professor So-and-so, when I graduated he was head of the architectural school and he came up and took me kindly by the hand and said, 'My boy, you weren't cut out for an architect, you ought to be in the musical line, and for Heaven's sake don't try to put a roof up.'" The lawyer said, "When I graduated from the law school the professor told me, 'For Heaven's sake, don't ever let any defenseless client depend on you for conducting a law case.'"

Mr. Canby.—Mr. Ingalls' vivid description of the method of performing the school or college analysis emphasizes an advantage which I have observed that the schools situated near the field of operation had in fitting their men for "the entering wedge," in that their instructors and students were familiar with the prevailing technical methods of analysis, or "assay."

For a time this was particularly so at Golden and I became accustomed to send to the Colorado School of Mines when I wanted a chemist for immediate service.

One time, however, I sent from San Luis Potosi for a chemist, and to my surprise found that the young man whom they sent was unfamiliar with the usual methods of analysis, and was unable to go immediately into the laboratory and do "a day's work" as previous Golden men had done, although he was an unusually bright young fellow.

I met Dr. Chauvenet, in Denver, not very long afterwards and spoke to him of my disappointment. "Yes," he replied, "I stopped all that! They were commencing to look upon Golden as an assay school, and not as a school of mines."

The Chairman.—I do not see that this section can really say very much against the young graduate, because every member has at some time or other in the course of nature been a young graduate himself. I suggest that we rise in a vote of thanks to Prof. Peele first and to the gentlemen who have contributed so much to the evening.

Meeting adjourned.

A. P. Watt,
Secretary of Section.

DISCUSSION.

Subsequent to the meeting of the New York Section at which the subject of Education of the Mining Engineer was discussed the following communication was received from the Chairman of the Committee on Technical Education.

F. F. Sharpless, Secretary,

Mining and Metallurgical Society of America.

Sir:

Supplementing my contribution to the discussion at the meeting of the New York Section on December 18, I would like to state through the medium of the BULLETIN that the Committee on Technical Education solicits from members of the Society any expression of ideas on this complex subject they may care to submit. As I believe is general with engineers, the members of the Committee feel that technical education divides itself naturally into three headings. First, the study of the underlying sciences, the application of which constitutes engineering; second, a sufficient amount of cultural study, particularly the use of English; and third, practice in the application of the foregoing to the greatest extent possible consistent with the time to be disposed of. Underlying the whole, and a consequence of proper teaching methods, is the development of the ability to think.

With reference to the three cardinal points, it is quite evident that the great question is the proper division of time among them. This is the essence of the problem which your Committee has before it, and in endeavoring to solve this problem we are engaged in the examination of the curriculum of the Mining Engineering schools of the country. This, as will be appreciated, is no small task, so that—although we are progressing—it would be impossible to say at this time when final report can be rendered. Meantime, the Committee will be only too glad to receive the ideas of the members, either through the medium of the BULLETIN or directly addressed to the undersigned.

ALLEN H. ROGERS,
Chairman, Committee Technical Education.

New York, Jan. 8, 1920.

The following discussion of Professor Peele's paper has been received from Mr. J. Volney Lewis in response to the request from the Chairman of the Committee on Technical Education:

For many years it has been my privilege to take a minor part in the training of engineers—civil, electrical, mechanical, chemical, and ceramic, but not mining. In all of its divisions, however, the problem of engineering education is much the same.

Aside from the essentials, which Professor Peele has covered so adequately, and which in varying degree are part of the curriculum in all the schools, it matters little what the other studies are, if only they broaden and humanize, cultivating in the student a wider sympathy and vision. The narrow specialist is handicapped in a phase of his work that grows constantly more and more important in these latter days—his relations with his fellow men. The successful organization and direction of the great human forces, which are sometimes antagonistic and are prone always to inefficiency, calls for the exercise of the highest qualities of the engineer. This has been called "human engineering." It is the branch in which the man who does not see over the rim of his own little groove oftenest fails, and it is the field in which the broad-gage man wins his greatest successes. I would urge, therefore, that we give our engineers the broadest possible human touch and sympathy.

Emphasis has very properly been laid on such fundamentals as mathematics, mechanics, and the like. I am sure no one would question their place of prime importance in the training of the engineer, but the over-emphasis of such studies, which call into play only the powers of deduction, leads to an unsymmetrical development. The man who deals with natural phenomena in so many of their manifestations must also be trained in the more difficult and equally important inductive method. The engineer is called upon to make exact observations of facts and to collate, classify, and co-ordinate his data. He must use judgment in weighing his facts and a fine discrimination of values in drawing conclusions. The forms and relations of an ore deposit, for example, involving questions of structure, origin, and extent, are no less fundamental than the design of a power plant or a mill, and often they lay a heavier tax on the engineer's ability. I would, therefore, balance the intensive drill in deduction by a thorough grounding in the methods of the natural sciences—not a mere introduction to a few related branches, but a thorough-going program extending throughout the course. For the mining engineer the bulk of this work should naturally be in geology.

Reference has been made to the engineer's need for initiative and ability to think. In this I fear we are apt to expect too much of the schools. The development of the thinking power can be fostered or discouraged, but not created, by the school. Thinkers, like poets, are born, not made, and no process of training can do more than develop the talent with which the student is endowed. It is a matter of common experience that the capacity for independent thought is exceptional. The great majority of us run with the herd—we follow the crowd. We are cogs in the machine and are driven by it, not driving it. We lack the courage, the initiative, the ability to climb out of the age-worn rut of the commonplace and the conventional. The man who thinks, who faces and overcomes obstacles, who takes hold and does things, is always the exceptional man. It is pre-eminently the business of the professional school to find this man and develop him for the benefit of the race. More important far than any detail of the curriculum, then, is the problem of segregation, of sifting out—the concentration of the values, as it were, from the mass of crude ore that comes in ever-swelling volume to the mill of the technical school.

It is sheer waste, stupendous waste, trying to make engineers out of men who lack the innate capacity, in either ability or temperament, for the profession. Less than half the students who enter our engineering schools complete the course, and a large proportion of the graduates fail to pursue the professional career for which they have been trained. Here, to my mind, is the collossal defect of the schools today. Dedicated to science, they muddle along in a most unscientific and inefficient fashion. Fortunately this fault is now generally recognized, and educators, in their efforts to find a remedy, are looking hopefully to the new psychology.

To eliminate the incapables, the hewers of wood and drawers of water, and also the temperamentally unfit, however able—this is the great service the schools may yet hope to do for the engineering profession. But in order to accomplish it the educator himself must represent the best type of "human engineer." It cannot be done by the underpaid drudge in whom ambition has been killed and all enthusiasm quenched. On this Society and similar organizations there rests a real responsibility to uphold both morally and materially the standards of the teaching staffs in the schools. To the man of vision in the profession there comes the clear call for service and for sacrifice. In no place can the high-minded, self-denying man of ability more effectively serve his profession and the race than in the schools that are training the engineers of the future.

To sum up, then, I would supplement the fundamentals in the curriculum with more humanistic studies; I would provide more thorough training in the inductive sciences to balance the intensive drill in mathematics, mechanics, etc.; I would concentrate effort and resources on the training of candidates selected for their fitness for the profession; and lastly, in order that both the selection and the training may be done the more effectively, I would urge the necessity of manning the schools with the highest type of men.

COUNCIL.

EXECUTIVE COMMITTEE.

A meeting of the Council was called for December 18. At the last moment the President and two members of the Council were called out of town. Mr. Ingalls, Mr. Penrose, Mr. Yeatman and Mr. Sharpless being present a meeting of the Executive Committee was called and transacted such business as required immediate action.

In the absence of Mr. Knox, Mr. Ingalls was called to and occupied the chair.

President Knox submitted in writing proposals for making three slight changes in the Constitution and By-laws. These were the same changes that had been suggested at the previous meeting. It was moved and seconded that these alterations be submitted at the next meeting of the Society called for January 13, 1920.

The Secretary read a report of the Schneider Dinner Committee respecting its receipts and expenditures. The final statement, which is subject to some slight alterations, will be filed with the accounts of the Society. It is sufficient to say here that the expenses of the dinner amounted to something over $2,000, while the receipts were about $35 less. The Council instructed the Secretary to adjust the final deficit from the general fund of the Society, if it did not exceed $25.

Report of the 1920 Medal.—The Secretary advised the Council that the Committee having in charge the recommendation of names to be submitted to the Council for the 1920 Medal, had not yet been able to make its report and that in consequence of this the President would probably not be able to make the announcement of the recipient at the usual time, at the annual meeting in January.

At the previous meeting of the Council, it was suggested that members be given an opportunity to contribute in excess of the annual dues of $10, some additional amount toward the expenses of the Society. The Secretary reported that the responses to this letter had been very generous and that a satisfactory financial condition of the Society was assured for 1920.

The Work of the Society for the Coming Year.—This matter was discussed, but it was decided to make no recommendation at this time, but leave the matter in abeyance until the election of new officers at the annual meeting in January.

The election of the following members was announced: Herman Garlichs, L. F. S. Holland, E. P. Mathewson (medallist), Harry L. Mead, Sidney Rolle, Charles A. Smith.

The meeting adjourned at 6 o'clock.

F. F. Sharpless,
Secretary.

ANNUAL MEETING.

AFTERNOON SESSION.

January 13, 1920.

The annual meeting of the Mining and Metallurgical Society was called to order by the President, H. H. Knox, at 2 o'clock, January 13, at the Columbia University Club, New York City. More than one-third of the membership being present in person or represented by proxies in the names of those present, the chair ruled that a quorum was in attendance.

The minutes of the previous meeting held on January 14, 1919, and printed in the January Bulletin of that year were approved as printed.

The Secretary read the report of the tellers who had been appointed by the President to canvass the votes for officers for the year 1920. It read as follows:

To the President
of the Mining and Metallurgical Society.

Dear Sir:

We have examined the ballots cast for the election of officers of the Society for the year 1920 and beg to advise you that we find that 178 legal ballots have been voted. The following candidates have received a majority of the votes cast:

President	*Vice-President*	*Secretary*
Waldemar Lindgren	W. Y. Westervelt	F. F. Sharpless

Councillors

Districts 1-2-3-4
H. H. Knox

District 6
F. G. Cottrell

Districts 9-10
Albert Burch

District 5
R. A. F. Penrose, Jr.

District 7
H. V. Winchell

John W. Mercer,
F. R. Weeks,
Tellers.

The President thereupon declared that these members, having received the largest number of votes for their respective offices, were elected.

The Secretary then read the report of the tellers in reference to the referendum upon the resolution of the Committee on Economics. This showed that 166 votes had been cast, 156 in favor of the resolution and 10 opposed to it.

The President then called for the report of the Secretary for the previous year.

REPORT OF THE SECRETARY FOR 1919.

It is customary at this time for the Secretary to make a summary report of the activities of the Society during the year which has just passed. Those who have read the BULLETIN have already a general knowledge of what the Society and its officers have tried to do and what they have accomplished, but as in previous years much work was done of which no record was printed. Inquiries and requests on many subjects and from many sources both from within and from outside the membership of the Society have been considered and replied to. No mention is made of these in the BULLETIN because the subjects have not been of wide interest, but they have been given attention by your officers because of real interest to the parties concerned. The work of the Society, in which all members have been interested, has had largely to do with those problems that are at present confronting the whole nation; problems of readjustment, reconstruction or, as our President put it a year ago today, problems of "reorganization." Whether we have accomplished much in this line that was really worth while, only time can tell. The problem is so big and we are so small that our most strenuous efforts may not make much impression on the course of events or may not be of much influence in guiding men of affairs, and yet your officers feel that the work has been worth doing, that many of the contributions and their discussions have been valuable and well worth while and on the whole that the Society fulfilled its mission during the year 1919 and enters the year 1920 with continued and increased respect for its standards and attainments from all those who are acquainted with its activities.

Labor has come in for considerable discussion at our meetings, perhaps with no direct benefit to labor, but with perhaps a great deal of benefit to those of us who come in contact with labor. At this period of our national existence, economic questions are of greater interest than are those of pure technology and the engineer accustomed to study matters from an analytical standpoint, is mentally well equipped for taking part in their study and solution. Not only physical but mental labor has received consideration at our meetings. Like the poor, we have with us always the engineer just graduated from college. Many of us have passed through the trials of this period and have had a deep realization of our shortcomings. Today we are further along on the road, but looking back, we can see the new men coming on, many of them passing through those experiences which we can recall so well. There is no subject that is more worthy of attention than that of making men more useful to themselves and to the community in which they live. It is possible for us to help the coming generation of engineers by assisting those responsible for their education in outlining and limiting their college work. It is possible for us to help the coming generation of miners no less than engineers. Your retiring President has been fully alive to what the Society can and should do in this direction and has been able to secure the promise of a number of our members to work on educational subjects, committees are already at work on Technical Education, Post Graduate Education and Occupational Training. It is probable that during the coming year some interesting reports will be presented by the committees.

But right here, permit me to point to the fact that the Society can not expect to accomplish its maximum of usefulness if the initiative of all movements and activities is left to councillors and its elected officers. We may not be democratic in the sense that we are willing to accept any and every man as a member, but we are certainly democratic in our form of government and your officers feel that it is their duty to carry out your wishes rather than to originate all of the programmes.

You have been fortunate in the past in your selection of Presidents who could work and who have worked and they have been largely responsible for the success of the Society. It is to be hoped that those who follow will bring the same spirit with them, the same eagerness to do their share and accomplish equal results. But still, fellow members, we are not fulfilling our part as members of the Mining and Metallurgical Society when we pay our $10 or $20 or even a larger sum. The work of each and every one of us is to give some useful thoughts, spoken or written as the case may be, or perhaps it may be a few hours of work occasionally, without hope of any recompense, further than that which comes from a consciousness of having done something that was worth doing.

Early in the year it was suggested that it might be advisable to have standing committees on each of the more important metals and committees were named upon chromium, mercury and molybdenum. Up to the present time none of these committees have been active, no reports have been called for and none submitted.

As stated previously the work of the early part of the year had largely to do with reorganization problems and the Assistant Secretary, Mr. Sturgis, found his time fully occupied until he resigned at the end of July. Since that date, the Secretary's office depending upon voluntary service, has not been able to do all that might have been done to advantage. Circumstances have been such, however, that the present incumbent has been able to give a considerable portion of his time to it, and with the assistance of the President, Mr. Knox, the ex-Secretary, Mr. Huntoon, and Mr. Ingalls, we have managed to keep the affairs of the Society up to date.

Bulletins.—Owing to conditions in the printing trade our BULLETINS have been printed with irregularity during the last half of 1919 and because of the congestion in the shops, it seemed advisable to combine the months of July and August, September and October and November and December into three bulletins respectively, instead of six. Arrangements satisfactory to the Council for the printing of the BULLETIN for the coming year have not yet been made and in order to keep our expenses at the minimum it may be advisable to double up in some issues during the present year.

Amendments to the By-Laws and Rules.—Certain suggestions have been made to the Council requiring, if approved by the membership, slight alterations in the By-laws and rules of the Society. Upon vote of Council it was decided to bring these before the annual meeting. The suggested changes have been printed and lie before you.

Membership.—The membership of the Society stands practically the same as it did a year ago; the number of those who resigned or were dropped for non-payment of dues is about the same as the number of new members. A number of applications are now on file and the prospect for a further increase in membership is promising.

Following are the membership statistics since the organization of the Society:

One Year to	Elected	Died	Resigned	Dropped	Net Gain	Total Membership	Before Council	Before Society	Applications	Total Candidates
June 1, 1908—Charter members						115	..	..	..	..
Jan. 1, 1909	31	0	1	0	30	145	..	..	20	20
Jan. 1, 1910	27	1	8	0	18	163	3	..	9	12
Jan. 1, 1911	31	2	3	2	24	187	8	5	6	19
Jan. 1, 1912	49	6	1	0	42	229	3	2	11	16
Jan. 1, 1913	13	2	6	0	5	234	0	1	2	3
Jan. 1, 1914	10	3	3	1	3	237	6	4	6	16
Jan. 1, 1915	34	3	7	0	24	261	2	0	10	12
Jan. 1, 1916	24	4	8	2	10	271	2	4	7	13
Jan. 1, 1917	22	6	1	4	11	282	3	0	3	6
Jan. 1, 1918	24	2	3	0	19	301	3	6	2	11
Jan. 1, 1919	26	4	14	3	5	306	4	5	0	9
Jan. 1, 1920	17	3	10	5	1	305	3	5	3	11
Totals	308	36	65	17	190					

It may be pertinent here to remind ourselves of the fact that we can not remain stationary as to membership; we must grow and expand or we will shrivel. There are many men in the country who are eligible to membership, who will not apply of their own volition, largely because of the fact that we have the reputation of being very exclusive and they fear they may be blackballed. From time to time, we hear an engineer friend drop a remark to the effect that this thing or that ought to be done by the mining engineers. Such are the occasions when our members should say to such friends: "The Mining and Metallurgical Society is the proper medium for accomplishing what you desire, join that Society and it will help you put your ideas through." One of the greatest helps that an inactive member may be is that of suggesting the names of suitable members; it is an assistance which is keenly appreciated and the Secretary earnestly requests the co-operation of every member who believes that the Society should grow.

Gold Medal.—It is mandatory to announce at the Annual Meeting, the name of the recipient of the Society's gold medal for the year. This year that will not be possible. There are two reasons for this. During the summer and fall months when this matter should have been brought before the Council, it was impossible to secure a meeting of enough councillors at one time to take the formal steps required by the rules. Members of the Council were unable to attend meetings because of professional engagements. When, finally, the formal action of the Council was secured and the suggestions of members had been referred to the Medal Committee, the date was so late that this committee was unable to complete its labors in time to refer its report back to the Council for the final action previous to the Annual Meeting.

In order to avoid this infraction of the rules in the future, and in order to make the selection less a matter of routine and one more of distinction a slight change in the rules has been suggested and will be formally presented by the Council at this meeting.

Formal Actions.—On April 16, Mr. E. L. Dufourcq, one of our members, was killed by bandits in the State of Pueblo, Mexico. While this was no greater crime than hundreds of others that have been committed in Mexico during the past few years, it struck nearer home and the Council felt that formal action was both proper and advisable. Formal resolutions were drawn up, adopted by a unanimous vote of the membership and placed in the hands of the authorities at Washington. This action, of course, produced no appreciable effect in Washington, but it was worth doing as it recorded the protest of 300 more serious minded men, a protest against the continued disorders in Mexico and lack of a serious endeavor at Washington to put a stop to them.

Formal action was taken respecting certain alterations to the By-laws. The Committee on Economics submitted a resolution for formal action. It has been voted upon and the result has been announced today.

F. F. Sharpless,
Secretary.

REPORT OF THE TREASURER FOR 1919.

In submitting the report of the Treasurer for 1919, I would particularly call the attention of the members to the fact that the Society finds itself exactly in the same position as every other Society and business organization, namely, with far higher costs for rent, printing and services. Perhaps the Society is even in a worse position than other organizations from the fact that more than two years ago it was decided to reduce the dues to the pre-war rate within a year after the cessation of hostilities. To meet this situation the Council decided to ask those members who felt that they could do so to supplement their dues by an additional sum to be used in meeting the expenses of the Society. A letter was sent out to this effect and the promises of additional contributions have been most liberal. I think that I am perfectly safe in saying that the finances of the Society for the year 1920 are, or soon will be, in a perfectly satisfactory condition, notwithstanding the very material increase in all of its expenses, and I am the more safe in making this statement from the fact that a number of members have written to the Secretary to the following effect: "I herewith enclose my check for twenty dollars toward the expenses of the Society for the year 1920, if this is not sufficient to meet our requirements I shall be pleased to add to it."

Previous to the war the annual expenses of the Society approximated $2,500; during the war they rose far above this, amounting in 1918 to nearly $8,000 due to our increased activities as well as higher costs. Beginning with July, 1919, our activities were reduced to those approximately of the pre-war days, but notwithstanding this reduction the necessary expenses of 1920 promise to be nearly double those of 1916 and 1917, or about $5,000. While it is now time to think of the financing of the Society for 1921, the members of the Council feel that this had better go over for a few months awaiting developments and the trend of events.

I shall not burden you with reading a statement of the accounts. These have been audited and the statement of the auditor has been printed and lies before you. If there are any questions to be asked respecting our disbursements or receipts, I will be glad to answer them.

Medal Presentation Dinner.—The final accounting has not been rendered, pending some slight adjustments still to be made. It may, however, be stated that the cost of giving this function exceeded the receipts for dinner tickets by about $600, and that this amount was subscribed by some thirty-five members, hence, the general treasury of the Society will be called upon for less than $35 in the adjustment of this account.

The treasurer's statement of receipts and expenses follows:

RECEIPTS.

Cash on hand January 1st,	1919		$341.18
Annual Dues	1918	$100.00	
Annual Dues	1919	5,810.00	
Annual Dues	1920	170.00	
Annual Dues	1921	30.00	
Voluntary Contributions	1920	155.00	6,265.00
Sale of Bound Volumes	1917	3.00	
Sale of Bound Volumes	1918	373.50	

Sale of Bound Volumes 1919	8.32	384.82	
War Committee of Technical Societies:			
Returned Assessment		45.30	
Interest		52.44	
Annual Meeting Dinner		135.00	
L. D. Huntoon and F. F. Sharpless—Office Rent		270.00	$7,493.74

EXPENSES.

Assistant Secretary	$800.00		
Office Rent	900.00		
Stenographer	1,220.25		
Office Expenses, Stationery, etc.	590.71		
Office Furniture	82.50	$3,593.46	
Annual Medal, 1919	$145.05		
Annual Medal, 1920	12.04	157.09	
Annual Meeting, 1919	$224.71		
Annual Meeting, 1920	14.25	238.96	
Special Meeting		13.00	
Exchange		4.08	
Binding Volumes, 1918		327.19	
Bulletins		1,245.40	
Constitution and By-Laws		126.50	
New Members		80.95	
Council Meeting		4.24	
Referendum Notes		44.30	
Local Section Expenses		73.99	
Affiliated Societies		30.00	
Cash in Bank, January 1st, 1920		1,522.58	
Check Not Deposited		32.00	$7,493.74

ASSETS.

Cash in Bank	$1,522.58	
Dues Payable, 1919	220.00	
Check Not Deposited	32.00	
Office Furniture and Fixtures	149.00	
1 Bond: New York City 4½% $150.00	147.75	
2 Society Badges	10.00	
Payment for account of Annual Medal 1920	12.04	
Payment for account of Annual Meeting 1920	14.25	$2,107.62

LIABILITIES.

Life Membership	$150.00
Payment in advance for dues 1920	170.00
Payment in advance for dues 1921	30.00
Payment in advance for bound volumes 1919	8.32
Voluntary Contributions for 1920	155.00
Estimate of Cost of November and December Bulletins	350.00
	$863.32

F. F. Sharpless,
Treasurer.

The above accounts have been audited and final entries have been made in the ledger by Charles T. Howell. The following is a copy of Mr. Howell's letter:

December 31, 1919.

To the President and Councillors of the
Mining and Metallurgical Society of America,
New York City.

Gentlemen:

Acting under appointment by the treasurer of the Society, I have audited the accounts of the Mining and Metallurgical Society of America for the year 1919, and hereby certify that, to the best of my knowledge and belief, the statement of the receipts and disbursements are correctly set forth and that the balance sheet presents the true financial condition of the Society.

Respectfully,

CHARLES T. HOWELL,
Auditor.

The President then announced that the next business before the meeting would be the consideration of amendments to constitution, by-laws and rules.

PROPOSED CHANGES IN THE CONSTITUTION AND BY-LAWS.

In order to preserve the continuity of the work of the Society, it has been proposed that the retiring President shall become a member of the Council, *ex-officio*, for the period of two years. The Council of the Society approves of a change in the Constitution to permit of this and herewith submits the proposal for consideration at the annual meeting of the Society.

According to present by-laws, the election of officers is announced at the annual meeting and if such officers have any remarks to make there is no opportunity given to prepare them. It is suggested that the ballots be canvassed a week in advance and reported to the President so that the latter may have an opportunity to advise the incoming President of his election. In order to accomplish this a slight change must be made in the by-laws. The Council submits this change for the consideration of the meeting.

According to the present rules for awarding the gold medal of the Society, this must be done annually and on a fixed date. It has been suggested that it would be better to make the presentation when occasion arises and leave the occasion optional with the Council. The Council submits this suggestion for consideration of the Society.

The three suggestions were discussed at some length by those attending and upon vote, members expressed their approval of making such changes in the constitution, by-laws and rules as would permit the proposals to become operative.

The President, Mr. Knox, preceded his announcement of the adjournment of the meeting with the following remarks:

After two years of concentration on the war and its problems, the M. M. S. A. like the rest of the world, has devoted the year just closed to reorganization for meeting the new conditions of peace. Faithful to our declared purpose to dedicate ourselves to the readjustment of the mineral industry, we have after much meditation and discussion concluded that our highest usefulness as a Society rests with the promulgation of fundamentals rather than with details or special applications. After determining the vital elements on which must rest any effective readjustment of the mineral industry it was perceived that the only effective way to elicit thorough discussion and consequent action by the membership lay through preparation of the ground by committees which would undertake the study of particular subjects and submit their conclusions to local or general meetings of the Society for debate and finally to the membership for action. Organization for the attainment of these ends has been necessarily slow and laborious but I am pleased to announce the formation of committees on Economics, Research, Occupational Training, Technical Education and Post Graduate Education. Of these the first has already afforded to the Society ample evidences of its activity, while the others are laboring arduously, if still silently, at their allotted tasks. In them reposes the promise of such fruitful effort as to assure to the Society a coming year of productivity and usefulness.

The work now being performed by the chairman and members of these committees, by many private members, by general and local officers, and eminently by your vice-president and secretary—onerous, disinterested and, save by their own consciences, unrequited toil, is beyond praise and I only ask you to join with me in high appreciation of their loyalty and devotion. Here I use the word loyalty in the sense of fidelity to an abstraction, rendered from altruistic motives, without the stimulus of other reward than the satisfaction found in promoting an ideal. Than this there is probably no higher attribute of man and it may not be irrelevant to indicate its development in the briefest possible terms.

Several years ago certain sociologists were much concerned about the activities of predatory gangs of boys in the slums and undertook the serious study of so-called gang loyalty. The investigation called forth an interesting contribution from the psychologists, who pointed out that the life of the individual repeats the successive stages in the life of the race. The instincts of the lad are tribal and as the savage yields his devotion to his tribe so does the boy to his gang unless this instinct can be diverted to school or club or other equivalent. Quite as the ethnic group, with the advance of civilization, expands the object of its loyalty so does the individual as he matures extend his fealty to college class, then to alma mater and finally to his country. But here intervenes a hiatus. Love of country is a constant flame but it is not, and cannot be, a steady flame since it will range through all intensities from a white heat to a comfortable glow, according as it is fanned by changing circumstances.

What opportunity then has the engineer after leaving college for the exercise of purely altruistic loyalty? Little indeed, I maintain, save through our own organization. If service to his country exerted through the medium of his profession is with him a compelling motive, he will find in the Society ample scope for its expression. On the other hand, the value of the Society is a precise multiple of every man such as those I have mentioned, enrolled in its membership. If the proportion be too low it will go the way of the unfit. If the proportion be large enough to supply the driving force behind our aspirations, then indeed will be justified my abiding faith in the high place which this Society is destined to hold in that field of activity it has elected to cover, a domain in which thus far it stands unique.

On motion the meeting adjourned until 8 P. M.

F. F. Sharpless,
Secretary.

EVENING SESSION.

Thirty-five members and guests gathered at the Columbia University Club for dinner at 6:30 P. M. Shortly after 8:00 o'clock the President called the second session of the meeting to order, with the following remarks:

"Gentlemen, there is no meeting so favorable as that of the annual meeting of the Mining and Metallurgical Society for the members and the officers to get together. There may be another general meeting during the year and there may not be.

As a matter of fact, last year there was only one general meeting except the annual meeting and for that reason I am going to invite the members present, after the more formal part of the proceedings are over, to express themselves informally and frankly, to give us their observations and views, especially in connection with the general policy of the Society. In this connection I will ask you to remember that criticism, even unfavorable criticism, is welcome when it is constructive. I hope, therefore, that there will be a response when the occasion comes. Will the Secretary be so good as to announce the election of officers?"

After the Secretary had read the names of officers elected for the year 1920, and had explained why the award of the Gold Medal could not be announced at this time, the annual presidential address was delivered.

ADDRESS BY H. H. KNOX, PRESIDENT.

It is established custom that the President of a scientific or technical association in his annual address should report the progress of that science or art of which he is a practitioner but this is a custom to which we of the M. M. S. A. cannot adhere for the reason that we are not a technical society. We are a society of technologists bound together for the purpose of debate and action on subjects allied to technology and tributary to it. On another occasion I attempted to define my conception of the purpose of the Society as the pursuit of the philosophy of mining and metallurgy as distinct from the art, and propose now with your indulgence to trace the idea a little further toward its root and to share with you certain reflections on

THE SIGNIFICANCE OF CULTURE TO THE ENGINEER.

If philosophy be essentially the quest of fundamental principles and the establishment of the relations between those principles, the attitude of mind which it engenders may be called culture, if one may restore to usefulness a word grown jaded by overwork and abuse. Culture is not learning, it is not scholarship, it is not appreciation of the fine arts. It has been described as knowledge of "the best that has been known and thought in the world," but to my way of thinking these are but means to an end, means toward the cultivation of the mind into a useful instrument at the ready service of the character behind it; for the mind is a useful instrument only when it is capable of clearing the visions of cobwebs, of stripping the cant and slovenly processes of thought from the problems of life and disclosing their elements. This is a return to the original sense of the word which applied to the tillage of the ground, the breaking up of the soil and destruction of weeds so that the fruits of the earth might yield their best. This I take to have been the meaning underlying Descartes's assertion that all the details of knowledge have no value save as they strengthen the understanding; that the mind is not for the sake of knowledge but knowledge for the sake of mind. Thus by implication Descartes exalts culture above even his own prodigious invention of co-ordinate geometry.

A body of men like ourselves who have undertaken to contribute of our knowledge and experience toward the enlightenment of ourselves and the better education of the coming generation of engineers, is bound to take under advisement this element culture, to define its place in the general scheme and to consider to what extent a liberal education is necessary to its attainment. The first question to be met is one that is rife about us, "What is its practical value? How will it help a man to make his living?" If by a living is meant mere food, shelter and amusement the question would be debatable, but if it includes the implication that man cannot live by bread alone the answer then is obvious.

William James, the practical man of philosophy, if ever there was such a thing, introduced the term *fringe of consciousness* to describe the penumbra that, scarcely recognized by ourselves, hovers about our thoughts like a nimbus and forms the great reservoir from which our ideas are drawn and shaped. This fringe is the great inchoate mob of our past experiences, fragments of which are seized by the intellect and forced into line in the train of thought. For lack of it the infant cannot think. Because of the wealth of it we call Shakespeare a genius. Is culture practical? In so far as it extends the fringe of consciousness it is incontestably practical. Let us go far enough afield to see clearly and draw an actual case from medical practice for an illustration. Two physicians are trying out a serum for the prevention of influenza. The first has given thirty injections and only two of the patients have taken the disease. He is therefore favorably impressed and adopts the treatment. The second is equally fortunate and is also favorably inclined but from his academical course at the university there lingers some faint recollections of algebra including such a thing as the theory of probabilities. He therefore decides to suspend judgment until the data of ten thousand trials have been collected and submitted to an actuary or mathematician for analysis. Evidently this physician has found a liberal education practical.

There are regions of the earth where the explorer for mineral would barter half his geology for a better knowledge of anthropology. In parts of Africa the ancient workings afford the only indication of the presence of ore. The outcrops are buried or obliterated, the workings are caved, nature's records have become effaced by time and where geology fails to give the clue anthropology must be invoked to unlock the secrets of the ancient diggings. Of what race were these old miners? Were they seventeenth century Portuguese or a Semitic folk of Solomon's time? We must know their cultural level before we can estimate why they abandoned their work, whether because they had exhausted all the ore or only that portion which they were capable of treating. For example, the ancient Egyptians understood only the smelting of oxidized copper ores whereas the Romans of the Empire had already learned to treat the richer sulphides. Again, in the Caucasus Mountains, all traces of ancient activity have disappeared save the slag heaps dotting the wooded slopes. Who were these old smelters—Phoenecians, Greeks or Venetians? Did they haul fuel to the mines or carry the ore up the mountain side to the charcoal supply? Did they understand the treatment of sulphides or was oxide smelting the limit of their art? Such speculations as these crowd upon the inquiring mind and on them may depend whether the prospector is to spend heavy sums on exploration or pass on to other fields. From the foregoing I shall scarcely be misunderstood as advocating a chair of archaeology as an adjunct to every technical school but I am insisting on the development in the young engineer of the cast of mind that will enable him to attack from every side the problems that confront him.

It is the utilitarian aspect of the matter alone which may properly concern us now and from the utilitarian standpoint we cannot wholly ignore the bearing of the humanities on the development of the imagination, and this is what Henri Poincaré, profound metaphysician as well as mathematician, had in mind when he wrote: "There remains in our classical education I know not what of the old Greek soul—something that makes us look ever upward. And this is more precious for the making of a man of science than the reading of many volumes of geometry." The perfect complement to this idea is Voltaire's assertion that "there was more imagination in the head of Archimedes than in that of Homer," no doubt for the reason that Archimedes knew Homer while Homer was unacquainted with Archimedes. To the testimony of the physicist and of the man of letters may be added that of the biologist. Charles Darwin allowed his aesthetic faculties to become completely atrophied and lived to utter his bitter regret. If therefore we reject the Humanities as a necessary part of our scheme of technical education may it be only after careful consideration of the question in all its bearings.

A liberal education leads to culture which is the light in which a man may know himself and hence can present both to himself and to the world a concrete entity free from those inconsistencies and contradictions that tend to befog his intercourse with himself and the world. In this light he sees clearly where he stands and whither he faces and so in times of crisis he takes his stand promptly without misgivings and without hesitation. A generation ago it was said of the American that

"Dazed by many doubts he wakes
The drumming guns that have no doubts,"

as if Kipling's prophetic vision had been fixed on the two harassing years following the "Lusitania" atrocity.

Most complex problems resolve themselves into a few simple elements when divested of their non-essentials and this is true of the social crisis confronting us now as of the national crisis preceding our participation in the war. The struggle raging about us is the simple issue between individualism and socialism, an issue, however, which will never be decided by any amount of argument nor appeal to reason since it is a matter not of the intellect but of the feelings.

The original Marxian communism, reduced to its simplest form, demanded equality of reward for all alike regardless of service rendered; but this crude polity has been, in the course of time, so modified and amended as to be no longer readily recognizable. Nevertheless today throughout the wide diversity of socialistic teaching there is always discernible the common foundation of class advantage. Marx would have reduced all classes to a homogeneous proletariat while many modern exponents, still clinging to a universal proletariat, conceive it as divided into heterogeneous groups among which inequalities of reward cannot be logically excluded. Be that as it may, the party platform of 1908 can be taken as fairly representative of the Socialist policy of the time as epitomized in the concluding paragraph—"Such measures of relief as we may be able to force from capitalism are but a preparation of the workers to seize the whole powers of the government, in order that they may thereby lay hold of the whole system of industry and thus come to their rightful inheritance." The appeal of this policy is twofold. It promises that every worker shall share equally with his fellows *all* the profits of his industry while they will share his losses by protecting him in sickness, old age and unemployment. This is a powerful address to the feeble in health, mind or character.

On the other hand, the individualist recognizes a natural inequality in men, physical, moral and intellectual and aims to foster such variation to the public advantage. He perceives that the promotion of civilization has owed immensely more to the exceptional minds and spirits who have stood forth as leaders than to any tendency of the average masses of mankind to improve themselves. It is no exaggeration to assert that Gallileo did more to advance experimental science than was accomplished by all the minds in all the ages that divided him from the schools at Athens and Alexandria.

Individualism for the time being is in disgrace in the estimation of those who exalt the word above the thing. The word has fallen into bad company along with Grasping Monopoly, the Old Order of Things and other disreputable characters, while socialism is permitted to claim identity with democracy. Nevertheless a moment's reflection will show the confusion involved in any such association of ideas. Individualism is incompatible with special privilege or class advantage for the reason that these obstruct the freedom of self-development which should be open equally to all men. Have we overcome the menace of monarchical socialism only to submit to popular socialism? Of the two there is something to be said in favor of the former. There have been beneficent monarchs while the beneficent Demos is somewhat open to skepticism. But if we are to adopt socialism let it be with eyes wide open and in full understanding of the terms and because we believe that man is made for the state. If on the other hand, we believe that the state is made for man then let us stand up and be counted as individualists. Whatever danger may be apprehended from socialism proceeds less from the avowed socialists than from that numerous class of citizens whose sympathies rather lean toward individualism but who are too indolent mentally to range themselves with any school of thought. These need only to be shown the path and they will tread it but if they are not shown the right path they will drift along the wrong one.

The individualist and the collectivist must indeed travel a long road together before they reach the parting of the ways since collective action is as necessary to the development of the full powers of the individual as to the development of groups or classes, hence the distinguishing test applies less to their acts than to their ultimate aims and we align ourselves not with a philosophy but with one of two ideals according as either may promise the fairer future of the race. The choice lies perhaps rather with the heart than the head, nevertheless it is a choice which must be made by every man who elects to fill his place in the community.

We are told that a hundred thousand years slipped by before paleolithic man learned to chip the edges of his flint knives and polish his stone implements, thus rising to the neolithic cultural level. Many backward races whose brain structure is not inferior to ours have not yet improved the ploughshare beyond the pointed stick and the great masses of Russian peasants are to this day ignorant of the use of manure as a fertilizer. Why? The origin of the ancient civilizations on navigable rivers or coasts is no coincidence but accords with the law that human progress is a function of communications. Primitive groups no doubt have produced their share of talent but among them the man of genius, unless of the warrior type, has had no scope beyond his immediate community and for want of intercourse with neighboring communities has been unable to raise the level of his tribe. This seems to explain why human groups dependent for advancement on average men require periods measured by milleniums to mark any progress whatever, while the development of communications accounts for the astonishing acceleration of knowledge in modern times. The result owes little to rapidity of travel but everything to the superior system of correspondence between mind and mind to which must be attributed in some degree the preponderant intellectual output of certain parts of Europe over the rest of the world. To contrast with the sluggishness of antiquity the rapid diffusion of the present perhaps no better instance offers than that of a certain physicist who once lived and labored in the uncongenial atmosphere of New Haven, unappreciated by his university, ignored by his countrymen. It remained for Europe finally to discover him to the scientific world and to proclaim Willard Gibbs the foremost genius in his sphere America has yet produced. Thus through their societies and periodicals the educated classes are provided with such ready means of communication that a minor improvement in New Zealand technical practice may within a negligible time become operative in Alaska.

So much for the educated classes, but what of the great inarticulate masses of workers who do not write technical papers nor read them? What profitable intercourse with one another have they? It is no mere fancy to liken modern industrial wage earners to the primitive races of antiquity or the backward peoples of the present. Both are incapable of progress unless it is imposed from without and the Watts and Stephensons and Arkwrights cannot be cited in contradiction. You do not improve the artisan by putting improved tools in his hand. The taxi driver of today is less dexterous than the cab driver who preceded him. In the crafts generally manual skill is declining. But contrast the artisans with the farmers. The latter in advanced lands, impelled by self-interest, have established such relations amongst themselves as to make it possible for an improvement introduced by one to leaven the whole industry so that progress in agriculture results from the combined efforts of the experiment stations, the scientific agriculturists and the husbandmen themselves. The mineral industries on the other hand, have utilized to their benefit the brain workers alone to the neglect of that great reservoir, hitherto untapped, composed of the mass of manual laborers. When that too shall be brought into the partnership, when its mental resources are stimulated, organized and marshalled, there will open up possibilities in industrial progress which it would be futile to attempt to forecast. The prospect has all the attraction of an undiscovered country and it is reassuring to observe that pioneers, including among others Leitch in this country and Whitley in England, are already setting forth to explore it. The primary principle of such workers as these is intercommunication among laborers afforded by meetings for the purpose of discussing improvements in methods and conditions of work and the secondary principle is the direct communication between such groups and the management, the whole structure resting on a foundation of individual self-interest and all to the end that a hundred minds and wills may be systematically bent toward industrial and social betterment where one acted before.

If, as I believe, the mental stagnation of the laboring classes is attributable to a stagnant environment then evolution can be promoted only through variation of the environment. By means of intelligently directed experiment, through trial and error, the right variations may be found that will accelerate evolution even to the degree which the biologists term mutation. At all events evolution will, if I may hazard a prediction, lie in such directions as will summon to action the latent mentality of the manual laborers and so blur the sharpness of the line now separating the work of the hand from the work of the brain. Through such movements as these lies the promise of a new era of which the coming can be hastened by the earnest attention and friendly interest of every employer. The application of systems of similar aims to the peculiar conditions of mine and smelter is a task that will tax to the utmost the trained faculties and disciplined sympathies of the engineer at the same time that it challenges his ambition by the breadth of the prospect opened out.

Science is all-sufficient in the laboratory but fails as a guide in human relations. It can study the worker as a mechanism but culture must examine him as a man, though here again the ground has first to be cleared of encumbrances.

Perhaps the most widespread and insidious impediment to straight thinking on the present day issues is the insistent repetition of the phrase "democratization of industry." This rolls as glibly off the tongue of the man in the street and the labor leader as of the journalist, the cabinet minister and the capitalist. The sense behind the term baffles analysis save that it falls soothingly on the ear and sounds like the solution of the industrial problem. Clearly each proponent has in mind the democratization of some other industry than his own since its proposed application to a government department, a bank or a railway would provoke the derision of the responsible manager of such institution as well as of every intelligent employee.

Years ago Brooks Adams likened the capitalists of his day to the old régime of France, rushing headlong to destruction, blind to the writing on the wall until finally the storm burst and enveloped them. The warning passed unheeded until the gathering tempest began to disturb their slumber and now the employers are beginning to shake their heads and murmur that "Labor has had a raw deal." Yes, labor has had a raw deal but the avowal comes about ten years too late—too late to save piece work, too late to save the stop watch and all that it implies; because the employers would not play the game and, so, by impairing good faith, threw away the opportunity to promote that mutual confidence and trust which must now painfully and slowly be built up anew along different lines. Such a consummation is being opposed in strange quarters, by the wealthy supporters of revolutionary periodicals, by the women of social position who throng at the feet of academic anarchists and by timid millionaires making for shelter under the radical cloak. To certain ominous portents which already point uncomfortably to the fulfillment of Adams's prediction, may be added the tendency toward "conciliation" and "democratization," when the emphasis should be on co-operation and organization and a constructive plan to help labor to help itself by contributing more to the national wealth and thereby earning for itself a larger share thereof.

There is, however, a group of men thoughtfully, earnestly and laboriously engaged in working out some scheme which will co-ordinate labor and capital effectively and profitably, with the aim of bringing these lifelong antagonists into partnership. When such men apply the term democratization of industry they use it with some definite meaning attached to it and it is therefore worth while to examine into that meaning. They strive through discussion and debate to arouse the handworker's interest in his own task and in the relation of that task to the process on which he is engaged. They aim to give him the fullest possible autonomy in all matters concerning his own well-being; to provide such freedom of intercourse between employer and employee as to develop mutual understanding, confidence and community of interest, to foster the duty to one's self that embraces duty to one's neighbor, and, to quote an eminent scholar, ultimately so "to co-ordinate the man who works with his hands, the man who works with his brains and the man who works with his savings that each may reap his just share of the reward." This is not democracy. A despot can conceivably govern the people for the people. Democracy means government *by* the people, a principle never in its entirety adopted by commonwealths more extensive than the Greek city-states or the Swiss cantons and which greater and more complex communities for the sake of efficiency must in some degree renounce. If pure democracy is inapplicable to the relatively stable political structure, obviously the conception has little application to the intense competitive activities of industry, struggling incessantly for survival, dependent for very life on the best abilities of the exceptional few. What term then can be substituted for the specious phrase democratization of industry, pernicious because to the unthinking it suggests ideals that are futile, dreams that cannot be realized? I submit that what is meant is the *humanization* of industry, for this includes the transference of the manual worker from the inorganic category to the organic and the association of a heart with the brain of the employer. The road is straight though it may be rough and the goal is attainable if only the leaders arise to point the way.

That the Great War found us unprepared is a truism; that it also leaves us unprepared is too fresh an experience to be the platitude that it will one day become, and among the new public responsibilities so suddenly thrust upon us perhaps there is none we are so ill prepared to face as the matter of taxation. To liquidate the principal and pay the interest of the war debt and the vastly increased public expenditure an unprecedented proportion of the national income must be expropriated by the Government and redistributed among the people. But when we come to enquire on what principle of equity or ethics the levy is to be made we find none. We find that all the stress has been laid on the details of taxation to the neglect of any fundamental theory to which the details may conform. As it is, each detail is discussed without reference to any accepted standard and the result is chaos. The time seems opportune, therefore, to revive a subject that has lapsed into singular disregard. Adam Smith, no doubt, announced his four classic maxims dealing with contribution in proportion to ability to pay; finality; convenience; and low cost of collection. Those are rules that make no attempt to penetrate below the surface, but three-quarters of a century later J. S. Mill essayed a more philosophical statement in his declaration that "Equality of taxation as a maxim of politics means equality of sacrifice. It means apportioning the contribution of each person toward the expenses of government so that he shall feel neither more or less inconvenience from his share of the payment than every other person experiences from his." This principle admirably responded to the simpler conditions of the middle of the last century when it was taken for granted that the only motive for taxation was to cover the expense of administration. Since that time other conceptions have attached themselves and taxation is gaining general recognition as a potent engine of social reform until now it is possible to distinguish at least four motives, such as the purpose of revenue alone; class benefit as, for example, a protective tariff; political, as the fostering of industries necessary to warfare; and punitive. It is this last which is of deepest concern since in the estimation of some observers it is rapidly taking on such proportions as to cause alarm. From its beginning in high excise and license in restraint of the liquor trade, it has been extended to various institutions obnoxious to the public. It is a method especially appealing to the type of mind, brilliantly exemplified in Congress by the late leader, Kitchen, to whom taxation is a bludgeon to be used on the heads of publicans, sinners and corporation lawyers. The punitive motive makes its strongest appeal to the immature mind by virtue of its simplicity rather than its logic. Is excessive consumption of alcohol an evil? Reduce it by making it expensive. Has personal wealth been used to the public detriment? Tax it out of existence. Have any trusts been directed to sinister ends? Confiscate them all. These are not the vaporings of schoolboys; they are policies actually advocated and practiced by chosen representatives of the people. The growing tendency to enforce social and political prejudices through taxation is best expressed by quoting a judicial opinion recently handed down in New York State: "All sorts of social reforms to be brought about through processes of taxation are in the political air, with the result that to many deep thinking men the economic future is full of dubious signs. Some, indeed, profess that a political and social strife has already been declared in the region of taxation and people of property are beginning to claim that taxation in aid of social reform is a clear usurpation and unconstitutional."

How is this situation to be met? Clearly by opposing to the punitive motive another of the same category which shall by its reasonableness be acceptable to rational persons and which shall be constructive, since passive opposition can exert little force against the militant doctrines of any well knit minority however small in numbers. If the seeker happens to be an adherent of the individualistic philosophy he must as a consequence adopt the principle of "taxation of opportunity," understanding opportunity in the sense of luck, priority, unearned advantage. Abhorring alike special privilege and special disability, he would refer the evil doer to the policeman rather than to the tax gatherer and leave the well doer to pursue his course unmolested. Indeed such is his appreciation of ability and virtue that he would encourage them by leaving them so far as possible unrestrained while to the utmost directing the incidence of taxation against the gifts of nature and of opportunity rather than against man's utilization of those gifts. This means the assessment of monopolies such as public franchises; of land values rather than the improvements thereon; of deforested land rather than reforested land; of deposits of mineral rather than of the increment of profit wrung from them by talent. It means the taxation of unearned wealth to the corresponding relief of earned wealth.

In the application of this principle there is nothing new. It is recognized in this country by the inheritance tax and by the limitation of traffic rates and in England by the taxation of the unearned increment of land values, but this, as well as any other principle, fails of general recognition as a standard by which all schemes for the collection of revenue can be appraised. To it the obvious objection will be advanced that it is impossible of application; that, as a concrete example, an ore body cannot as such be taxed until its value has been proved. To this expostulation let Mill reply in his own words —"Standards of perfection cannot be completely realized; but the first object in every practical discussion should be to know what perfection is." Indeed, the test of an ideal is not whether is can be attained; it is enough that it can be approximated.

My endeavor has been to trace to their base within the briefest possible compass a few of the most insistent current questions of concern to engineers because of my deep conviction that unless such questions are analyzed into their elements no synthesis is possible, no foundation can be laid on which a lasting social structure may be erected. The Anglo-Saxon race is unique in its disregard of analysis and in its complacent pride in "muddling through." We have muddled through our wars at a scandalous cost of life and treasure; we are muddling through our political economy, our race questions, our industrial problems, muddling each matter as it arises for want of some recognized criterion or standard of reference. By dint of incessant repetition of the word we make ourselves believe that we find a bench mark in democracy, forgetful that democracy is only an expedient, a means toward an end which is liberty.

Prophets we have had but they have been as voices crying in the wilderness and we have heeded them not, while today the welkin resounds with "the prophets of the utterly absurd, of the patently impossible and vain." Each of us must, then, perforce be a prophet unto himself, and this is the whole substance of my theme. Whether my conclusions find acceptance concerns me not at all, but what does matter vitally is that every one of us should think such questions out to a finish and search his heart and his mind to their depths for those first principles on which alone he can take a secure stand amidst the tumult and the travail about us and so help his fellows to a firmer footing.

ADDRESS BY WALDEMAR LINDGREN, PRESIDENT ELECT.

Mr. President and Fellow Members: Permit me to express my deep appreciation of the great honor you have conferred upon me by electing me as President of our society for the present year and let me say that I shall, to the best of my ability, carry on the splendid work of my predecessors. Technical men and engineers in general have been accused of lack of public spirit, of burrowing, each in their own little molehill of specialty and detail. I do not think the sweeping indictment is justified, but to each of us the election to a position of trust involving wider outlook can not fail to be beneficial and for each task undertaken in this direction we should certainly become better citizens and better workers for the welfare of our country.

Only too late did I realize that I might be called upon for a presidential address. And if you note, as I am afraid you will—that this discussion does not measure up to the high standard set last year I wish to ask your indulgence. You will find that these pages consist mainly of a few remarks on statistics. They are sweetened here and there by a dash of geology from which it is too much to ask that a geologist should wholly abstain. Finally you will find them diluted by some political economy presented apologetically with something of the feeling of Pilate when he inquired, "What is truth?"

I have chosen as my subject a brief consideration of the present status of the gold production of the world, its future prospects and its relation to the price of gold.

Previous experiences are not encouraging for those who would attempt a prediction of the course of the world's production of metals. Even where estimates of available resources can be made the industry refuses to follow the prophets, for unexpected reserves appear and the definition of available ore must be revised downward. Still more hazardous is the forecast of the production of the precious metals, for here the available ore is generally beyond exact estimation. We all remember how roughly the early views of the future of gold and silver were treated by the actualities of development, how ores previously despised became assets of tremendous value; how the costs of treatment were lowered; and how fast the new discoveries appeared on the scene.

I speak on the subject with some personal feelings for in

1902 I ventured to suggest[1] a probability of a moderate decrease in the gold production for the United States, though recognizing the liklihood of an increase in the world's production. The relentless statistics supported this view for a brief period but in 1905 began a rapid upward swing, the output in that year increasing to about $88,000,000. The increase continued with unimportant interruption to 1909 when a maximum of nearly one hundred million dollars was reported. The new discoveries in Nevada and Alaska nullified the predictions. Another feature, the wonderful increase in the production of copper, which brought much gold as a by-product was not taken into consideration.

The future course of the gold production of the world is, of course, a much more complex problem and may well be approached with much trepidation. I do not intend to take up your time with recital of the well known facts: How the output has been steadily and rapidly increasing since the eighties during which a level production was maintained of a little over one hundred million dollars, to nearly $307,000,000 in 1899; $454,000,000 in 1909 and to a maximum of $469,000,000 in 1915. Twice, from 1900 to 1902, and from 1913 to 1914, there was a slight backset, due to local and well recognized causes, but the upward grade still seemed to continue.

STATISTICS.

For many years the Director of the U. S. Mint has undertaken the important work of collecting the statistics of the world's production of gold and silver and we may well be proud of the universal recognition of this as the most authoritative statement. Nevertheless the careful observer will note that even in this compilation there is much room for improvement. It would be well worth while for the Bureau of the Mint or for the Geological Survey to employ for this work a specialist with thorough technical and cosmopolitan knowledge of the geology, mining and smelting of the precious metals.

CRITERIA.

There are many factors to be considered in judging the probabilities of increase or decrease in the gold production of a country. First, the nature of the principal deposits: They may be shallow placers exhausted in a few years, but on the other hand there are countries like Alaska and California which boast of gravel beds so extensive that they last for many decades. The lode mines may be of the type of deep seated origin like those of Brazil, California, the Porcupine district or South Dakota; in these the ore may be of lower grade but there is a marked stability of yield. Or again the lode deposits may be of the type formed near the surface like those of the Comstock, or the Goldfield district in which case the ore is often of high tenor and the production dazzling but not lasting.

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[1] Trans. Am. Inst. Min. Eng., vol. 33, 1903, p. 811.

In the second place, there are the discoveries most likely of course in new countries. These possibilities are difficult to appraise but always are to be considered. Who would have thought that Mexico should become an important producer of gold? And yet, there is the El Oro district in a well prospected part of the country, in which the riches simply happened to be covered up by a sheet of lava until adventurous souls had the nerve to drive a few tunnels.

In the third place, there is the cost of treatment. Thousands of ingenious men are ever striving to decrease this item or to increase the recovery. In a certain district this cost may be $10 per ton. This ore is worked out and the vicinity lapses into somnolent repose. A few dollars decrease in the cost of treatment and presto, there are now ore bodies waiting for the drill and the powder. When we see serious attempts made to mine ores containing less than $2 worth of gold per ton, each one of us begins to think of this or that locality where there are masses of material which may be drawn within the definition of ore. So except in a few districts the calculation of gold reserves becomes an operation of very uncertain value. Do you realize what it would mean to the gold production of the world to have the working costs on the Rand reduced by one dollar per ton? With this in view the prophet after a while is likely to acquire a wholesome conservatism.

The factors enumerated above are those which normally affect the gold production. As we all know only too well the conditions brought about by the great war of 1914-1918 have added other factors which have influenced the gold mining industry to a most disastrous extent. As the price of gold is not supposed to have been increased while the costs of production involving labor and supplies have increased tremendously, it has come to pass that many gold mines have closed down, that development has lagged, and new enterprises have been left in abeyance. A reduction of the gold production was the natural result, moderate in some cases, alarming in others. This again, has been followed by a flood of recommendations and reports and papers by congresses, commissions and individuals seeking to analyse and remedy the trouble. Remedies of all kinds, some ridiculous, others reasonable, have been proposed.

Evidently the first question is whether it is desirable and necessary to stimulate the gold production and to increase the national stock of gold. It appears that almost all bankers and financiers agree that this is desirable, and it was recognized even during the war that gold mining should be treated as a preferred industry. With the perversity which characterizes political economists there are, however, a few who insist that the tremendous influx of gold to this country during the war (increasing our stock of gold in these years by over one billion dollars to three billion dollars) promoted inflation of currency and credits so that a reduction of the supply would be beneficial in decreasing this inflation. It seems to me, however, that all countries with gold standard would naturally endeavor by all means to protect and enlarge their gold reserves so that the necessity of encouraging the gold industry is adopted here as axiomatic. During conditions of normal trade there would, of course, be continual fluctuations as international balances are settled and during the last year we have witnessed a marked outflow of gold though not large enough to create immediate apprehension.

In regard to gold production, I am now dealing with the present and the immediate future. The increase or maintenance of the production can apparently not go on forever, and there would seem to be an end in the distant view of commercial expansion based on gold credits. Of course all things have a limit: Every deposit will be worked out sooner or later, the inexorable depth and the internal heat of our globe increase the cost in spite of the engineer. The ordinary costs of mining and treatment can not be depressed indefinitely. Indeed they are now in many cases springing up to prohibitive heights. We might feel inclined to predict an almost total exhaustion of our gold bearing deposits in fifty or in one hundred years, were it not for the hopelessness of anticipating just what the human race will do in the next hundred years.

THE COMPONENT PARTS.

UNITED STATES OF AMERICA.

We are naturally interested in the position of the United States of America. In spite of a steady increase from about $33,000,000 in 1892 to treble that amount in 1915, the importance of the United States in relation to the output of the world has steadily diminished from one-third in the first mentioned year to about a fifth in 1915. The advance apparently culminated in 1909 with a production of nearly one hundred million dollars. Then followed four years of recession to $88,000,000 (in 1913) but in two years the lost ground was recovered. In the year 1915 the high water mark of our gold production was attained with a production of $101,035,700. Since then, the descent has been continuous to $68,500,000 in 1918 and it is believed about $58,000,000 in 1919. It looks truly alarming and Mr. H. N. Lawrie predicts an output of $40,000,000 for 1920.

The output of such an enormous territory involving all kinds of deposits is particularly subject to the delicate balance between character of deposits, new discoveries and cost of mining and treatment. There are strong elements of stability like the lode production of California, the deep mines of South Dakota, the new dredge fields becoming available and the gold as by-product of copper and lead ores.

There are also features working towards a reduction in the output: Among these may be counted the more or less rapid exhaustion of placers, the temporary yield of tailing piles and the prospective decline of certain lode mines, so often exemplified in Nevada. Dredge fields will not last forever; the exhaustion of some in California is probable. While recovery in concentrating tends to increase, and the metallurgical processes are improved, the wages and cost of supplies are increasing. Few new discoveries have been reported during the last few years, and the artificial stimulation of prospecting, tried, for instance, in Colorado some years ago, did not prove successful.

It requires more than ordinary acumen to sort and weigh all these factors. A few years ago I wrote (in an unpublished lecture): "It seems difficult to believe that any rapid increase above $100,000,000 can take place; there seems to be as many factors working for a reduction as for an increase. There are others, however, that do not look at the matter in this light and to whom it appears that enough of low grade ore bodies will be developed in the near future to offset the unfavorable aspects."

It seems worth while to examine the causes that have led to this depression in production. In some quarters high costs are blamed almost exclusively. I do not think that high costs are entirely to blame. In many regions labor is not excessively high, in many regions it has not risen as in the eastern coal mining districts and in the iron industry. There was, however, in 1919 a marked inefficiency and restlessness among the miners which made it very difficult to operate. Supplies have doubled in price or more than doubled. Electric power on which so many of the mines depend has not advanced greatly in price. I should say that on the average costs of gold mining have not increased more than 60 per cent. While some mines have closed down on account of these high costs, at least half of the reduction of the output is due to other and local causes. Surely the H. C. L. is not to blame for the flooding of the Treadwell mines, for the fire in the Homestake, for the exhaustion of the rich ores at Goldfield, for the working out of certain dredge fields in California, and Idaho, or for the closing of the Liberty Bell mine in the San Juan region. It is true that profits have been reduced and that development work has been retarded. On the other hand the days of new discoveries are not yet past, and many of the difficulties experienced in 1919 will be remedied in 1920. The production of silver and copper in 1920, for instance, will probably considerably exceed that of 1919 and the mining of these ores will produce a notable amount of gold as by-product.

The situation of gold mining is difficult but it by no means is desperate. I believe the production in 1920 will be much higher than the predicted $40,000,000.

CANADA.

The gold production of our northern neighbor which reached a maximum of about $18,000,000 in 1916 has slowly receded to about $14,000,000 at the present time. At present it is made of three components which a few years ago were approximately equal: Yukon placers, British Columbia lode mines and Ontario lode mines. The rapid development in the production of the latter has, however, more than counter-balanced a decrease from the Yukon and British Columbia. In 1919 Ontario is estimated to have yielded $10,200,000, an increase of $1,700,000 over 1918. The rich gold mines of Ontario are new discoveries. And who shall say that another field like that of the Porcupine will not be found in the wilds of the north? As in the United States the reduction in output of Canada is only partly due to increased costs. Natural exhaustion of the Yukon reserves, local troubles and exhaustion of reserves in British Columbia played the most important part.

MEXICO.

A score of years ago nobody would have classed Mexico as a gold producing country of any importance. The discovery of the rich and extensive ores of El Oro rapidly brought the output of the country to $25,000,000. In the last few years there has been a great drop and the figures for 1918 are estimated to $10,000,000. In great part this is caused by conditions of civil war, but previously to that the end of some of the great ore bodies at El Oro seemed to be in sight.

SOUTH AMERICA.

The South America production has practically remained constant for many years and bids fair to change very slowly; a continued increase may be expected from the placers and lode mines of Colombia, now yielding about $600,000,000, while some of the producing mines of Brazil are beginning to reach a depth at which further operations become difficult. Increasing activities in Chile and Peru may add slightly to their production of gold. For the world's production South America counts but little, contributing only about 3 per cent. to it.

AUSTRALASIA.

It is well known that the gold output of Australasia has receded persistently during the last decade. At present it forms only about 9 per cent. of the world's production. The decrease, chiefly apparent in Western Australia and New Zealand, is mainly caused by the beginning of the exhaustion of the rich ore bodies. It is probable that the decrease if maintained will proceed at a much slower rate and there are still possibilities of new discoveries as emphasized by recent news from Western Australia.

ASIA.

In British India the production of $12,000,000 which was maintained at that high water mark for several years has now declined to $10,000,000 (1918). The gold of India is largely derived from a few mines, exceeding 4,000 feet in depth, and difficulties owing to this depth appear in the near future.

Asiatic Russia is often mentioned as a coming country in the way of gold production. Before the war the Empire yielded about $27,000,000 annually of which a smaller part was derived from the diminishing production of the Urals, while much the larger part came from Eastern Siberia. Some of the placer mines like the Bodaibo of the Lena goldfields were yielding very heavily a couple of years ago. The lode mines contribute as yet but little. We have no data to gage the productive capacity of gold bearing gravels to be worked, but when stable conditions shall prevail the production will undoubtedly equal or exceed the old figures.

AFRICA.

A casual survey of the present conditions shows that the Transvaal now supplies 42 per cent. of the world's production and that in the main this output comes from a small district of a few hundred square miles. Only about $7,000,000 is derived from districts "outside" the Transvaal. This predominance of the Transvaal is the outstanding and striking feature in the story of the gold production of the world. Its spectacular advance is very largely Transvaal history. Fluctuations elsewhere are of less importance. Therefore, any prediction for the future must necessarily be based upon a close study of that district. No exact parallel to these South African deposits is found elsewhere in the world and geologists and mining engineers have advanced many conflicting theories as to their origin. At the present time the most prominent students of these deposits tend to regard these pre-Cambrian or Cambrian beds of conglomerate as alluvial deposits rapidly accumulated under especially favorable circumstances in the deltas of large rivers which probably had their source in the old, pre-Cambrian granitic and schistose rocks of the north. These old rocks contained the upper, extremely rich parts of gold quartz veins, now largely eroded. A protracted period of slow erosion weathering and decomposition set the gold free and ground it into fine particles. Though it is difficult or impossible to transport heavy gold in the water courses, fine gold is easily carried along and a sudden increase in the transporting power of the river coming at the right time might suffice to sweep large masses of this fine gold down into the deltas of the streams. The development of pyrite and the silicification of these beds are regarded as secondary metamorphic processes. The topography of the area of the crystalline schists to the north of the Rand is naturally wholly changed at the present time. The superficial placers once existing have been swept away. Nevertheless the richness of the region is borne out by the rapidly increasing production of Rhodesia which has doubled in a few years and in 1915 stood at about $19,000,000.

Predictions in regard to the permanence of the gold deposits of the Transvaal have not been fortunate; in all cases their possibilities have been underestimated. Owing to favorable geologic position and underground temperature gradient a much greater tonnage is available than was thought possible at first and just now the possibilities of the "East Rand" are looming up large. Whether all expectations be fulfilled or not it appears certain that there is much available ground to be opened up and there is always the probability that ore carrying less than the present cost of mining and reduction may be ultimately worked at a profit. As pointed out before, the industry has shown a remarkable strength and resiliency; not only has the output of the Rand exerted a dominating influence on the world's production for the last 25 years but unfavorable influences have affected it surprisingly little. There was a temporary backset a few years ago owing to labor troubles and rebellion; but the year 1915 closed in spite of difficulties of obtaining capital for new enterprises with a greater production than ever and more favorable prospects. There is no doubt that the present big mines of the Rand proper will be exhausted. One often finds statements like this: "It is estimated that in 1929 fully one-half of the mines now productive will have depleted their supplies of ore; in 30 years the output will have fallen from $190,000,000 to $40,000,000 per annum."[1]

However, with the prospective opening of the new mines of the East Rand it begins to look as if the production of the region could be maintained in its present volume for several years to come. It seemed hard to believe that there can be great advance over the present figures.

The production of the Transvaal mines stood at $173,600,000 in 1914. In spite of war conditions the advance continued and in 1916 a maximum of $192,200,000 was registered. A gradual decrease carried the output to $174,000,000 in 1918 and it is probable that the same figure will be closely approximated in 1919. There was, therefore, no such depression as is recorded from elsewhere. Labor has advanced in price but little; though, of course, supplies are equally or more expensive than elsewhere. In 1910 the average cost per ton is said to have been a little over 17s. In 1919 it is recorded as 22 or 23s. Several low-grade mines have been forced to close but others have found it possible to hold their profits by strict economies. It is worthy of note that, owing to the fall in exchange, an American company, operating in the Transvaal would expend almost exactly the same in costs in U. S. currency, in December, 1919, as in December, 1910, i. e., about $4.35 per ton. No sudden decline in the gold production is to be expected from the Transvaal, and this is of the highest importance since that region as stated is responsible for at least 42 per cent. of the world's production.

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[1] Min. & Sci. Press. Oct. 7, 1916. Editorial.

Rhodesia and West Africa are holding their own fairly well. The output of the former was about $16,000,000 in 1918 and the same amount will probably be recorded for 1919. The maximum for Rhodesia was $19,200,000 in 1916.

THE WORLD'S PRODUCTION.

I have already referred to the rapid rise in the world's production of gold which culminated in 1915, the amount being about $469,000,000. From here the descent was rapid to $377,300,000 in 1918. I should expect a production of not less than $350,000,000 in 1919, principally affected by declines in the United States, Russia and Australia. The decrease from here on is likely to be much less in proportion. The dominant position of the Transvaal would appear to safeguard the maintenance of the gold output about the present level for the next few years. It is now clear that only to a partial extent is the decline due to the increase in costs which has closed some mines running close to the margin. Political conditions caused the decline in Russia and in Austria. But the most influential factor aside from some misfortunes in mining operations would seem to be the simultaneous exhaustion of many of the richer deposits in the United States and in Australasia. To some extent those conditions may be counter-balanced by new discoveries, but as long as the Transvaal maintains its production I see no immediate cause for alarm.

USES OF GOLD.

Apart from a small consumption for chemicals the uses for gold are: First, monetary use either as a medium of circulation, or as a reserve backing issues of paper money. In this country a certain quantity of gold, 23.22 grains of pure gold, is defined by law as one dollar and paper money either explicitly, as in gold certificates, or by implication is supposed to be redeemed at this rate. In England one pound sterling is defined as 113 + grains of pure gold, hence the normal ratio between these two monetary units.

Second. Industrial uses, including ornaments, utensils, watches, etc. A great amount of gold is used for plating other metals used for many kinds of objects; this amount, of course, is wholly lost. This industrial use, as many authors have recently pointed out, has been rising rapidly in this country, and now is estimated to be $55,000,000 to $65,000,000 per annum, or more than the present annual national gold production. Assuming, therefore, that all the gold used comes from United States mines, there would be none left for monetary purposes. This condition is unfortunate, not entirely necessary, and its correction figures largely in the proposed remedies.

THE REMEDIES.

The remedies by which gold production may be increased include stabilization of industrial conditions, legislation and scientific prospecting. There is to my mind little hope that the period of high prices will soon be over. With copper mining once back in its former position a steady contribution of gold will be obtained as a by-product. This amounts at best in the United States to about $9,000,000 per annum. Scientific prospecting should be encouraged even if at first its success seems dubious or slow. At the present time very few of the large companies do any work of this kind. They have scouts out by the hundreds, but these men are looking for developed mines with ore reserves and will not glance at a prospect. Undoubtedly the gold miner has a grievance. His profits are diminished or cut out. The price per ounce of his product remains the same, i. e., $20.67 +. What is there to do about it?

The remedies for the miner which have been proposed include freedom from taxation, and a direct or indirect bonus on the production of gold.

The proposed corrections for the inflation of our currency run all the way from the use of debased coin to the resumption of bimetallism; it is thought by some that the establishment of a ratio between gold and silver and the accumulation of additional metallic stocks of silver would help in solving our problems. Such a suggestion has been recently advanced in the editorials of the *Engineering and Mining Journal*. However, in the present state of silver mining I would consider it highly hazardous to establish by law a ratio between these metals.

To correct the excessive use of gold Mr. H. N. Lawrie has proposed to pay a bonus of $10 per ounce of gold to the producers, this amount being obtained by an excise tax on gold sold to manufacturers. This plan has actually been endorsed by the American Mining Congress at the last November meeting of that body. Possibly such a plan might be feasible and it has been approved by some thoughtful men. It is a further step in advance in our policy of paternalism and I am doubtful about its expediency.

The facts relating to the price of gold are well illustrated by events in the Transvaal. Until recently the producers in

South Africa were obliged to sell their gold to the English Government, receiving for it not sovereigns but British paper currency. Now the course of exchange on London has clearly shown that owing to debts, bonds and issues of paper the British money has depreciated relatively to that of the United States. Some fluctuations of exchange may, of course, be due to other causes but when it drops persistently as has the exchange on England, France, Germany and Italy it indicates plainly a lack of faith in the ability of any given country to redeem its currency in gold. So the producers were obliged to sell their gold at a rate considerably less—as much as one-fifth or more—of what they would have received in a free market. The situation was rapidly becoming intolerable and last summer permission was granted to sell the gold in the best market which, of course, was in the United States—in other words, gold went to a premium. Recently a price of 109 shillings per ounce was paid in London.

Here in the United States we have likewise issued vast quantities of paper money and bonds but the credit of the Government is better, the faith of people is stronger that ultimately the promises will be redeemed. I believe it beyond question that even here the currency has an inflated value, that the paper dollar has ceased to be on equality with a gold dollar. Our faith upholds the fiction and we all accept what is really the depressed value of the gold dollar. Suppose now that gold is no longer sold by the Bureau of the Mint or that the sales are restricted. Suppose we restore the open, outside market for gold. Who can doubt that the result will be that here too gold will go to a premium, perhaps to $23 or $25. Those desirous of obtaining gold for whatever purpose would be obliged to enter the open market and bid for the product of United States or Australia or the Transvaal. Would not such a proceeding be fairer and more natural than the present fiction? Would it not also automatically reduce the excessive consumption of gold? Would it not also extend a valuable help to the gold mining industry? Any producer could take his gold to the mint and there obtain either the exact equivalent in gold coin at 23.22 grains per dollar, of paper money, amounting to the old price, plus the premium. Probably this plan has already been proposed; possibly it involves some insuperable difficulties, and I am sure it would meet opposition in Washington, but to my mind it would be worth trying. It is perfectly true that it would automatically raise the paper value of any gold bond, government or private, or any gold contract. It is also true that it would involve a partial suspension of specie payment, but is it not a fact that it is already practically suspended? It seems to me that it would be best to face courageously the inexorable facts. At present we have a depreciated currency and we pretend not to know it. With increasing gold production and deflation of currency and prices the premium would, it seems to me, be automatically reduced and we would gradually revert to the old, more stable condition of affairs. Naturally it would be necessary to prohibit melting of coins. But such laws already exist in most countries and moreover the great bulk of our gold is in the possession of the government or of the banks.

ADDRESS BY THE CHAIRMAN, NEW YORK SECTION.

Mr. Church.—Mr. Chairman, when President Knox was kind enough to find time for me this evening, I discovered that I had nothing to offer except a question. It is a very comfortable position, for the man who asks a question presumably is not required to know as much of the subject as the man who answers it. On the other hand, it is, of course, bad practice to ask questions without having one's own answers, good or bad; and I have my answer tonight. Nevertheless, the question is the essence of the contract.

The establishment of the first mining school in the United States is an event within the memory of men now living, and the extraordinary development of the industry in the intervening years has maintained strenuous demands on the strictly technical resources of the profession. Nevertheless, a large number of mining engineers have found their way into corporate management and have there faced the business problems involved; and whatever his field, these problems come to every member of the profession, whether they become his life work or remain merely the corollaries of the propositions he works out. It may be presuming on scanty evidence to say that the number of engineers in the business world is increasing; but it may well be so, for the engineer is trained to render service far beyond the technical boundaries of his field.

Now let us look at the back of the picture; that is, at the possibilities of development which the business world offers the engineer. Almost his first plunge will bring him into consultation with a lawyer, not because he wants to break the law, or has broken it, but because he wants to avoid breaking it. In other words, he faces an exceedingly complex mass of legislation, municipal, state and federal, which is apt to present a rather startling contrast to the great body of natural law with which he is trained to deal. At first sight the most commonplace of his other problems, such as finance and the curious phenomena of markets, seem to have the same purely human origin and opportunist characteristics that are so conspicuous in much of our legislation. We know otherwise; we recognize the laws of economics, and recently have honored them as a nation both in the breach and in the observance; but have we gone as far as may be toward finding a foundation of natural law for business phenomena, a foundation which would bring it within the boundaries of the technical field? There, you see, is my question.

The idea is a fanciful one, but it may be worth a moment's expansion. The engineer links together the research laboratory and the workshop; and in following out our idea, an analogy at once suggests itself between the relationship of research laboratory to workshop, and that of economics class-room to business house. Is there room in the latter group for the engineering link? There is always room, of course, for the application of known laws, and we have a distinguished body of financiers already occupying the ground; but our known laws cover only a part of the business field, and if we could codify the remaining phenomena and reapply the code to business practice, we should follow exactly the path that our predecessors opened when they brought mining to the status of a profession.

For such work there is no need of proving that the engineering method of thought is the best; in suggesting the problem I have defined the one type of man who can solve it. It remains to be proved that the problem exists at all, that underlying business phenomena there is a foundation of natural law, comparable in kind to the laws of chemistry, or of geologic relationship. Here I can go no farther, for I am only asking the question; they say it is easier to pilot an airplane up in the clouds than to make a good landing. Nevertheless, if you will momentarily accept the hypothesis, it may be interesting to follow where it leads.

Before touching the main problem, there is a detail of business practice in which the engineer can both give and receive help. Mining and metallurgical cost accounting is a specialty which in its higher branches requires engineering knowledge; the problems raised by mine depletion, by charging off the expense of development, by metallurgical losses and by cost inventories for a slow process like copper refining are peculiarly the engineer's province. Nor is this all. The foregoing examples are drawn from our own special field, because it is familiar; but throughout the whole range of cost accounting there are opportunities for the exercise of just those mental muscles which are developed in the technical school. Accounting, of course, is, or should be, a matter of logic, and to anyone who has not tried both, the likeness between designing a set of books and designing a structure or a process will be startling. On the other hand, the books are both a financial flow sheet and a powerful aid in organization; and finally, they will be the field data from which new principles of business will be deduced, if any there be.

Passing to our hypothesis itself, we might define business roughly as machinery for the exchange and distribution of the world's produce; or, as the point of contact between supply and demand. The latter definition, faulty as it is, gives us an avenue of attack; for one of the worst phases of business is its irregularity, the sequence of abnormally dull years on those abnormally brisk, and it is a natural step to seek the cause of these variations in the controlling variations of supply and demand. Speaking in the most general terms, and admitting all possible exceptions, we may yet say that variations of supply, if not due to natural shortage, are dependent on demand. Now, what varies the demand? Here we reach a complex of relationships between industry and industry, between industrial factors and financial factors, between these and human hopes and fears, which has never been brought under control. We know that there is a staggering total of misery which such control would relieve; we have made progress in its theory, and not one of us believes that it is inherently a mystery; but it still remains a problem. In reaching out for a solution, we can recognize the work of the great economists on the one hand, and the great financiers on the other, and yet find some excuse for trying those methods by which applied science has gone so far in other fields.

To show the value of knowing why supply and demand vary, we need only go to a familiar group of industries, of which agriculture may serve as the type. Here there is a seasonal variation of supply, which has been met on the commercial side by good financing and on the industrial by highly specialized methods of warehousing. The cause of variation was understood from the beginning, and it required merely good business organization to discount its effects. The same industries present seasonal demands, but except in the labor market their variation is regularly discounted and does no great harm; its effect on labor is a special matter.

Of those other and greater irregularities, the periods of depression whose causes we do not fully understand, there is a strong tendency to regard the remedy as a function of government, presumably on the theory that the official mind is best fitted to solve the problem. Without attempting final judgment, we may note that the results so far have not produced complete tranquility. Since the causes were not fully understood, much of our remedial legislation was really aimed at the effects, with marksmanship which sometimes included the innocent bystanders; and to put it mildly, we run a slight chance of getting some undesirable laws on our statute books. If we must have legislation, let it be aimed—accurately—at the causes; or better, let us stabilize our markets by completely outlining their fundamental laws, and applying those laws as assets instead of occasionally suffering from them as liabilities. Could this be done, the matter of legislation would perhaps take care of itself; no one tries to repeal the law of gravitation.

In the matter of discounting business depression, private enterprise has been rather more successful than the official public, for it has developed the big corporation. This particular form of depravity is supposed to seek its excuse in manufacturing economy, but I think it is even better justified by its services in finance. Markets may vary and profits be in abeyance, but the reserves of a big corporation under good management will carry it over the lean years without that failure and dissolution which means loss of capital to stockholders and community alike. There is another side to this picture, which is frequently forgotten today; when business is good, the corporation must win not only its normal profit, but enough more to compensate for the period of depression. It thus becomes an instrument in smoothing out the business curve, and its services in this respect come remarkably near reaching one of the causes of depression itself; for we may admit that uncertainty is among these causes, and the consciousness of reasonable safety a potent factor for good. Nevertheless, the big corporation still suffers from depression, and is still unable to prevent it, so we must look for additional means of control.

Incidentally, mere corporate bigness has brought its own new problems into the field, and here again we are offered the assistance of legislation. Unfortunately, some of the remedies have been based on the theory of the good Indian, and the legislators, like the medical profession, have buried their mistakes. I hold no indiscriminate brief for the big corporations of today, but the high value of their proper function in the industrial and financial worlds should require little proof this evening, and we may some day even regard them as the inevitable product of an evolution based on fundamental law. Should we come to this, and by applying our law find means to relieve them of any possible menace, the way would be open for placing organized capital in its potential position as a necessity of the public interest.

The mention of capital invariably calls to mind its fellow-worker. In the light of recent history, this term may sound a trifle sarcastic, but I have used it in a very different sense, for we all recognize that capital and labor have many interests in common, and the chief of them is work. The labor problem is primarily a problem of industry rather than of business, and as such is receiving the very careful attention of engineers the world over; last year the New York Section devoted some well-employed time to it, and the Society at large is working on it at the present moment, as we have seen tonight. Nevertheless, it is a business problem also, as the last few months have emphasized, and further, it presents a convenient stepping stone from the technical problems of production to those other problems of business which may turn out to be technical when we come to look them over. All that we need note here is that labor, yours and mine and that of the man in overalls, is a commodity subject to the laws of supply and demand—and in some cases to mighty little else.

This idea of technical possibilities in business, of making it a branch of applied science, is a dream or a reality, whichever you please. If it is a dream, the stuff that such dreams are made of has been supplied by the engineering profession itself, for more than one member of this Society has already begun the collection of data and the discussion on which the reality, if there be one, finally must be based; we have heard two addresses this evening which fulfil these conditions. Personally I believe that the engineers are going to work this thing out.

There is no need to remind ourselves of the amount of work there is to do. It will be a long pull and a hard pull, but it will also be a pull all together, and in this we always have the Society.

The President.—The formal part of the proceedings are now concluded. We have heard from two members who have addressed us by special invitation. I now invite the membership present to assist.

Mr. Addicks.—In regard to Prof. Lindgren's address, I might say that gold is being paid over the counter in New York today. I do not know to what extent. I cashed a check within ten days at a national bank in the city and just asked for gold as an experiment. It was handed out.

Mr. Chance.—Mr. Chairman and members: I have been trying for the last hour or so to crystallize whatever ideas I may have had in the last few years as to the sphere of usefulness which this Society might occupy in the future, and especially in the immediate future. The subject is not one that I feel prepared to speak on at length for the reason that I have not had time to consider it in its entirety, but in a general way for the last four or five years I have felt that the affairs of the Society have fallen in the hands of gentlemen who, in their executive functions, have been steering the Society along a path which was admirably adapted to make it a useful organization, useful to the public and useful to engineers. We are not, as the President has said, a technical society, though the Society is composed of technical men. We cannot very well go into the discussions of the details of practice. It seems to me that our sphere naturally is in the discussion of questions which may be termed more or less of a philosophical nature, questions involving broad principles of practice which concern engineers and which concern the community, matters of legislation, matters of public interest, and from the outset the Society has very largely confined itself to issues of that class.

To the individual member, the Society has a benefit in that it promotes intercourse among engineers of a class who are interested in general principles which should govern the profession. I remember some fifteen or twenty years ago at the American Philosophical Society hearing an address made by Frederick Fraley, a remarkable man. He was then in his ninety-third year but his annual address made a great impression on me. I cannot recall the exact words, but the substance of it was the American Philosophical Society was of principal value to its members by reason of the intercourse, the contact of member with member, the bringing together and holding together a body of men who had some interests in common. This, I think, is one of the elements of value that membership in this Society must always carry with it.

Regarding the matters which this Society can profitably discuss, it seems to me the principal one today is the one to which our President has devoted most of his remarks, the relations of labor to capital, or capital to labor. This is a subject that is going to be with us for many years to come. A solution is not going to be found quickly. Mr. Hoover in a recent article has defined the philosophy of the government of the United States as worked out by our people as being one which is based upon providing an equality of opportunity, that every individual shall have equal opportunity in this world to develop and make for himself a place. If that equality is denied then the object of our government fails. I am of the opinion that equality of opportunity is not enough. Equality of opportunity merely turns us loose in what might be termed a free fight and the issue becomes one of the survival of the fittest. The result is under the strong competition of modern civilization. A man may be born into this world with a wonderful mentality, a man capable of being of the greatest value to his fellow men if his mental ability is properly developed, but owing perhaps to lack of opportunity, aggressiveness, of incentive, of courage, or of self-assertiveness, he may fail in the struggle and becomes a member of one of the lowest strata into which the community is divided. On the other hand, with equal opportunity and unrestricted competition we have the man who is the man of no real ability, a man who would never devise a new method, never conceive of an improvement, may by his courage, his determination to win, rise to almost the topmost point, and therefore it seems to me that equality of opportunity alone is not sufficient, will not cure the unrest which we find seething throughout the great mass of our employes and factories and mills in what is termed our laboring classes. Some solution should be found that will strike at the root of the difficulty and remove that unrest. So long as that unrest exists we are going to have trouble. I do not know that I have any suggestions. I simply see this difficulty. Mr. Knox has suggested one helpful constructive proposal in describing how the employes may be personally interested in the work in which they are engaged so that they feel that they have an actual voice, not perhaps in management, but in securing the best results by utilizing whatever useful suggestions may be made.

As engineers, we are perhaps as well fitted to discuss matters of this character as any other class of citizens to be found in the community, for the reason that engineers gain very wide experience and familiarity with people and with the conditions of life in different portions of the country. The average city dweller knows very little of what is going on beyond what he can personally observe. For these reasons, Mr. President, while some of these discussions may seem to be purely theoretical and may not directly accomplish any result or prove of immediate value, at the same time all knowledge is of value. If engineers can give to the rest of the world the ideas which they form from their study of these sociological problems they will be doing their bit in helping to solve what seems to me to be the greatest problem of the age, the future readjustment, for readjustment must come, of relations of labor to capital in a way that capital will be protected and given its proper share and the laboring men will not feel that he is being poorly dealt with.

The President.—I can not refrain from commenting on one remark of Dr. Chance to the effect that we do not know altogether the cause of the present industrial unrest. A very fruitful suggestion, it seems to me, was made the other day by one who seems to find the underlying cause of the present unrest in idleness. Hours are so short, the short working hours are so unutilized that the laborer does not work hard enough to interest himself in his job and when the whistle blows he does not know what to do with himself, he has such a large part of the day on his hands. He has not been trained to utilize them, even in amusement. Whatever there may be in this I do not know but I think there is a certain suggestion of value attached to it.

The Chairman of the Committee on Military Education should have a few words to say to us, not exactly in retrospect, as nothing has been done by this committee, but much is promised by it and we all know the time is ripe for the Mining and Metallurgical Society to pronounce itself on this question. Mr. Kirby.

Mr. Kirby.—Our Chairman asked me this evening if I would say a few words as to what the Society hoped to do during the present year. All thinking men, as a result of this war, see very clearly that in the United States we must change our military methods, we must improve them. As you all know, there is a widespread effort to bring about universal military training. I am in sympathy with that and I think most of you are also. It is clear that we shall get something, some improvement over the conditions we had before the war. While the forces in that direction are taking form, a question that is part of it is something which is peculiarly our business, so much so that it is really our job, and that is the question of how to provide officers for this universally trained mass of young men which we hope to have in the future. Whether we get all we hope for in that direction or whether we get only a part, we must have officers for those who are to be trained. Our present facilities at West Point are utterly inadequate of accomplishing that end. Wars now are fought by nations, by vast masses of civilians, by masses running into the millions, such numbers that they will simply swamp out of existence any small body of officers or any small body of professional armies that we can create or are likely to create in this country. We must have officers and as the individual stories come back home of what occurred at the front I am sure it has been impressed upon your minds as it has upon mine that it is criminal to neglect this phase of the question, it is criminal in any future war to send our boys into battle without properly trained officers. We did the best we could with short training and hasty work and must never have to do that again.

In training officers in a big undertaking of this kind I believe in using the machinery which is already in existence and that machinery consists of all the technical schools, colleges, universities and various other educational institutions throughout the country. We, as alumni of the institutions, therefore have a big interest in this piece of work. The training of an officer is nine-tenths the training which is now being given by complete organizations in all of these schools, it is nine-tenths the training that you and I and all of us here tonight have been through, plus the one-tenth which is purely military. An officer is simply a good engineer who specializes, applying his engineering and general technical education to a special kind of engineering work and handling men in a peculiar way; therefore if the Government will simply supply to all our schools and universities this one-tenth in the form of the necessary money, the necessary military instruction and the necessary standardization of the course, it will have a complete working machine ready to turn out the officers that are needed. Personally, I believe that every engineer, every technical student in the country, ought as a part of universal military education be compelled to take training as a full-fledged officer and then after his graduation he may elect as to how much of his time he wishes to devote to that branch.

In talking this over with Mr. Knox early last summer, it was thought wise that our society should be given an opportunity to make a move in this matter. He asked me if I could take hold of the work and I explained that it would be practically impossible for me to do so because I had been giving all of my time for the past two years to public work, and he then asked me to take the position as Chairman of the committee until we could find others who were sufficiently interested to make an organized force, and with that understanding I went ahead but I have been out of the city nearly all of the season and returned only a short while ago and have not been able to do anything definite since then, but it was his desire and mine also that you should know tonight where this thing stood.

We, as the alumni of these institutions, are the only people who are qualified and in a position to take this movement and get it started. If we do start it, it is perhaps as interesting a piece of public work as our Society could undertake and I for one would be very glad to see our Society get the credit for initiating and getting it started. Sooner or later it must be done. There is no other way. There is no other means of getting these officers. Whatever system is worked out in the future some such scheme must be adopted. Every university, every college must be a training ground. These institutions must be the foresight standing over the country for whatever system of military training is adopted.

If we as a society can get this thing started the forces available, the forces that we can organize are very great. Every school and university in the country will of course be glad to get into it, be glad to start it. They have influence in every state. Their governors and their legislatures will not say no to an interest of this kind. Through all of these state officials and state institutions you can reach the House and the Senate at Washington. It requires the work of several men who can devote a large part of their time, who can push this thing hard and vigorously and as it ought to be pushed, and those men have not yet been found, so if our Society concludes to go on with this thing in its next organization of the Council, as I assume that they will from the situation as I have learned it, that is what we need. We can only find out the people who will help in this thing by asking them to inform the Secretary of their willingness to co-operate in the movement. You can not do it unless someone is interested, you cannot do it unless there are a few somebodies willing to sacrifice some of their time. There is a lot of work to be done. It will not do itself. Somebody must push it, and the object Mr. Knox had in asking me to say these words tonight was to explain to you what the idea was as briefly as I could and to say that help is needed if the Society is to undertake it, and also to state my own conviction that I do not know of a piece of work available for us which will be more worthy of our effort and will bring the Society more credit than to start this thing if we will do so.

Meeting adjourned at 10:05 P. M.

F. F. SHARPLESS,
Secretary.

Mining and Metallurgical Society *of* America

Vol. XIII., No. 2 February–March, 1920 Bul. 138

ANNOUNCEMENTS.

Bound Volume 1919.—The contract for the binding of BULLETINS for the year 1919 will be made about two weeks after this number is sent to members. Any orders received for bound volumes prior to May 1st can be filled under the contract. No extra copies will be bound and any later orders will be filled at additional expense.

Index to Volume for 1919.—The index will be ready for distribution on May 1st. Members desiring a copy of this will please advise the secretary's office to that effect.

Meeting of Sections.—The New York Section expects to hold its next meeting on April 8th at the Columbia University Club, New York City. The subject for discussion will be announced later.

COUNCIL.

Meeting of February 19, 1920.

A meeting of the Council was held at the Columbia University Club on Thursday afternoon, Feb. 19th. Those attending were Messrs. Lindgren, Cottrell, Ingalls, Knox, Penrose, Winchell, Westervelt and Yeatman.

President Lindgren occupied the chair. In the absence of the Secretary, W. R. Ingalls was appointed Secretary pro tem.

After the approval of the minutes of the previous meeting the President presented the report of the Medal Committee. As required by the rules, this report carried the names of two candidates with a statement of the work done by each along the lines in recognition of which the medal is to be awarded. Some additional facts were brought out in respect to both candidates by members of the council. The secretary was instructed to prepare a ballot carrying the names of the two candidates and forward to all members of the Council together with a copy of the report of the Medal Committee and a copy of the remarks made at the Council meeting relative to the work of the candidates.

The Council voted to sub-lease its office from Mr. L. D. Huntoon for the coming year.

At a previous meeting of the Council, Mr. C. R. Corning had requested the privilege of mailing a pamphlet on Bolshevism to members of the Society at his own expense under cover of the Society's stationery. By vote of the Council this privilege was granted.

Communications from the United States Chamber of Commerce from the National Public Works Department Association, and from the Joint Council of the Engineering Societies of San Francisco were laid on the table, being out of the province of action of the Council of the Society.

W. R. Ingalls and H. H. Knox were elected members of the executive committee. The members of the Executive Committee are now Messrs. Lindgren, Westervelt and Sharpless, ex-officio, and Messrs. Ingalls and Knox by election.

The committees on Chrome, Molybdenum and Mercury were abolished.

Mr. Knox was appointed a member of the committee on Post-Graduate Education, vice Mr. Yeatman resigned.

Meeting adjourned.

W. R. INGALLS,
Secretary, pro tem.

COMMUNICATIONS.

PRESENT STATUS OF GOLD PRODUCTION.

W. R. Ingalls.—At the annual meeting of the Society the statement was made by Mr. Lindgren that this country was no longer on a strictly gold basis, in other words, that gold could not be obtained in exchange for federal reserve notes. This statement was contradicted by another speaker who reported that he had actually obtained gold pieces from the banks at Christmas time. I could personally have reported similar experience, if it had seemed to be necessary.

What is more to the point is the indication of business on a large scale. The United States has lately been exporting gold in great quantity to South America, in settlement of adverse balances of trade, and there have been no restrictions on the market.

I recently had occasion to make inquiry respecting a possible transaction involving the securing of a large amount of gold in New York and took this up with the bullion department of one of the largest banks. I was assured that there was perfect freedom with respect to gold, that an absolutely free market exists, that any desired quantity could be obtained in exchange for federal reserve notes. This condition may not exist next year, or next month, or next day, but it does exist at present and has existed since restrictions on gold were removed, following the armistice. This statement of fact may help to clarify discussions of the gold question.

CALENDAR YEAR AND FISCAL YEAR.

The Imperial Statistical Conference has reached a practical agreement for making the calendar year the commercial statistical year throughout the British Empire. At present there is discordance, some colonies having a fiscal year ending with March 31, others a fiscal year ending with June 30, while in others the fiscal year is coincident with the calendar year. The fiscal year of the United States Government ends with June 30th. We shall probably be asked to change to the calendar year.

Inasmuch as the calendar year is the common statistical basis there ought to be uniformity with regard to it. Anything else greatly depreciates the value of statistics for economic purposes. A few years ago the Interstate Commerce Commission changed its compilation of the railway statistics of the United States from the fiscal year to the calendar year and enormously increased their value.

Mining and metallurgical companies generally keep their accounts and publish their reports on the basis of the calendar year, but there are a few that do not. All mining and metallurgical companies, and other industrial companies, ought to adopt the calendar year as a matter of uniform practice.

W. R. INGALLS,
Chairman, Committee on Economics.

ENGINEERING COUNCIL.

The Jones-Rives Bill.—Creating a National Department of Public Works was given a hearing before the Senate Committee on Public Lands on Feb. 11th. Mr. J. Parke Channing with a number of other prominent engineers appeared before the committee and explained that economy in public expenditures was the real object in the minds of those appearing. The attention given by the members of the committee and the intelligent questions asked, gave considerable hope to those furthering the matter that it would receive favorable consideration at the hands of Congress.

Compensation of Engineers.—The committee having this matter in hand has published an appendix to its earlier report. The appendix deals with the decrease in the value of the dollar and the intrinsic value of engineering service. While pointing out the inadequacy of the salaries now being paid to engineers, it draws particular attention to one feature of pronounced public interest.

It is this: Employers of engineers, by paying the market price, by permitting the law of supply and demand to fix that price without giving due regard to the quality of service rendered, are inevitably driving the better quality of men into other fields of occupation, leaving for engineering service the inferiors of the profession, and thus bringing down the quality of the service employed to a point where it is of a grade proportional to its renumeration.

The whole appendix is an excellent paper, one in which engineers will be keenly interested; but it is to be hoped that Council will be able to place it before the public, before the employers of engineers, for it is this portion of society that needs the enlightenment contained.

NATIONAL PUBLIC WORKS DEPARTMENT ASSOCIATION.

This organization is doing splendid work. If successful it will mean the saving of many millions to the national government and that saving will have been due almost entirely to the engineers of the country. The work of the Association, while progressing favorably, is by no means complete, it must continue until March 4th, 1921. To continue the organization and have it function properly, to reach the goal that it has set for itself, the goal we are all interested in seeing it reach, $60,000 will be required. This must come largely from personal contributions that engineers will make. There are about 100,000 engineers in the United States. The desired sum should not be difficult to raise. You are asked to send your contribution to M. O. Leighton, Chairman, McLachlen Bldg., Washington, D. C.

MEETINGS OF SECTIONS.

NEW YORK SECTION.

Meeting of March 4, 1920.

A regular meeting of the New York Section of the Mining and Metallurgical Society was held at the Columbia University Club on Thursday evening, March 4th. About forty members and guests attended. After the customary informal dinner the chairman, J. A. Church, Jr., opened the meeting at 8 P. M.

Mr. Church.—The subject of the evening is "The Political and Commercial Control of the World's Mineral Resources." It goes without saying that this is a matter of vital individual interest, and it is one upon which Mr. Spurr is especially fitted to address us. It gives me pleasure to present Mr. Spurr, the mining engineer, the geologist and the editor, and above all our fellow member.

Mr. Spurr.—With the rapid increase of the world's population and the exploring and exploiting of the hitherto undeveloped natural resources, competition for mineral wealth has become and will still become keener. In past ages war, pestilence, and starvation held down the earth's population; in the past five years all these grim specters have returned in force, suggesting the possibility of a return of the old primitive days. Nevertheless, modern science and organization, if not quenched by vast social disorders, will so safeguard life, as in recent times, that the world is in a fair way to become crowded. All of us, like Germany, yearn for our "place in the sun," and our share of comfort and power. Of all the fundamental necessities for this, nothing is so much in the nature of a fixed and unmultipliable quality as the metals; and they constitute the basis and foundation of our modern civilization and power over man and natural forces. Other raw materials are of vegetable or animal origin; they propagate and duplicate themselves in successive incarnations, according to the law of life, they are born in some magical fashion of air and water, with a minimum of the earth, and they return their loans faithfully to air and water and earth with the passing of each generation and the dawning of a new. There is the hint of such a law of growth in the mineral kingdom, but it is so vastly slow that the evanescent animal man has no personal interest in it; for all his purposes and by all his standards of measurement it is inert, and these riches, once dug and used, will never again be available. The treasures of commercially valuable ore-deposits have been hid by nature whimsically, throughout the earth, here and there, by no rule of geography or latitude, and with a great disregard of equality. A nation's needs or desires for mineral wealth have no stated relation to its actual mineral possessions; what it needs is often in the territory of another nation which does not need it. Commerce is thus born, and the nation which must have the metal or ore in question backs up its commerce and helps it to fasten its claims for permanent control of the deposits desired, by legislation, by diplomacy, and if need be, by war. In the case of war, the metallic prize falls to the strongest—usually the nation which, before, through its necessities, exercised only commercial control, but which as the result of the trial of strength, now frankly asserts its sovereignty.

Have we as Americans realized these forces? Absolutely not, I should say. How many realize that the Alsace-Lorraine question is not and never was a sentimental one, but a death-struggle for the greatest iron deposits of Europe and the second largest of the world, which gave Germany her immense growth and power, and may now transfer that wealth and power to France? That the dispute between Poland and Germany as to Silesia is not a question of nationality, sentiment, or even territory; it represents one of the greatest coal fields of Europe; if Poland gets it, she may well overtop Germany in wealth and importance; if Germany loses it, she may well drop into the position of a second-rate power, now that she has had to give up Alsace-Lorraine? To submit such a question to the vote of the native population, is of the same order of intelligence as tossing a coin for it, but how many of us have understood this? Population shifts and changes, swells or shrinks, may be at one time predominantly Polish and at another time mainly German; but the coal deposits are fixed. To clarify these things we should in place of Silesia say Coal, in the place of Alsace-Lorraine, Iron, and so on.

The reason we have not realized these facts is on account of our own vast mineral wealth, so abundant that not till recently has American capital and enterprise found it necessary to venture into the outside world, as the European nations had done long ago. Their natural wealth was limited so that they have become familiar with those fundamental principles or laws of which we have been unconscious. From this has arisen European foreign policies, the protection of their national commerce and national capital in foreign enterprises and consequently at home, as in Germany, England, France and Italy; while the United States has been engaged in its purely national pastime of "trust-busting" and has neglected as unworthy the protection of its investors in foreign countries. When these appealed for protection, as in the case of Mexico, the government informed them they should have stayed at home. This illustrates the difference between European diplomacy and American guilelessness. How well this played into the hands of foreign powers it is unnecessary to explain. The spectacle of the United States maintaining a Monroe Doctrine of protection over Latin-American republics which she took no vigorous steps to unite with her by the powerful bonds of commerce, must well have excited the amusement of those European commercial nations like Germany who have been strengthening themselves in those countries by the closest commercial and hence political ties.

In studying these problems of mineral control, the difference between political control (by which I mean, not control by the machinery of political parties, as some have surmised, but practically state sovereignty) and commercial control must always be kept in mind, and studied both separately and together. Commerce to a great extent controls politics and statecraft, directs its policies and brings about changes of governments, revolutions, conquests, and rearrangements of frontiers in accordance with its trend. Would we divine the future course of history? Let us study, not laws and constitutions, but economic pressure, and the perfection and power of organized commerce. Let us say, in the 16th Century Mexico and Peru have a wealth of accumulated gold ornaments—the world's greatest gold reserve of that age. A very wise man, without really being a magician, might have foretold to Montezuma the looting and conquest by the Spanish freebooters—and even with a long, long vision, our present Mexican problem. Let us say, in the last century, the Boer Republic has rich stores of gold and diamonds, which it does not use; but which attracts the organized commerce of the trading islanders of Britain. Would it have been extraordinary wisdom to have foretold from the start the present British Dominion of South Africa? Let us say that today China has coal and iron that she does not use, but which are greatly needed by the trading islanders of Japan. May not a wise man foresee beyond any question a permanent Japanese domination of China? And from that we can turn with more suspended judgment to the questions that are more balanced—especially those as to the ultimate changes in South America, which are due as a result of her mineral wealth. The changes which have already come about as a result of interactions between South American countries are only preludes. An example in the public eye at present is the Tacna-Arica controversy between Peru and Chile. This is summed up editorially by the *New York Tribune*, as follows: "The Bolivian delegation to the second Pan-American Financial Conference is asking moral support here for a sea outlet project.

Now land locked, Bolivia had a frontage on the Pacific. She lost it after rich nitrate deposits had been discovered in the desert of Atacama and in the province of Antofagasta. Bolivia was poor and misgoverned. She could not develop her riches. Chile entangled her in a web of concessions and exploitation agreements and finally forced her into war and seized her coast lands. Peru also was brought into the war of 1879 through her defensive alliance with Bolivia, and Chile conquered the Peruvian provinces of Tarapaca, Tacna and Arica and seized Callao and Lima."

Keep your eye on the ball. It is not so true that commerce follows the flag, as that the flag follows commerce. Formerly they sailed together in one ship—in the days of the armed expeditions of Dutch, Spanish and English, ready to trade or to fight. Now the navy hovers back of the merchant ships. With the growing scarcity of tin and silver and nitrates, with all the other coveted mineral wealth of South America, study the attack of various commercial forces there—study particularly the relations of England, America and Germany.

In order to comprehend the existing world situation, let us survey briefly some salient features of the distribution of mineral possession and control, and of the metallic balance of power. What among minerals are the most essential props to our mechanical civilization; and what are most important in our commercial competition and war, and what in the cruder strife of military forces? Most important doubtless are the fuel minerals, coal and oil, and the steel making minerals, iron and the ferro alloy minerals. Of enormous importance also are the four so-called non-ferrous metals—I think we should find some better name for the group—of copper, lead, zinc and tin. Nor must we forget, as an element of growing importance aluminum. In the group of non-metallic minerals comes magnesite, graphite, mica, and asbestos, all essential and important in their way. Then there are the fertilizer minerals—phosphate rock, potash, and nitrates. And lastly, come the precious metals, gold, silver and platinum.

Petroleum is at the present time the most critical of all minerals, as regards this problem of control. It is hardly too much to say that whoever controls petroleum rules the world. We have arrived at the stage when we apprehend that in a few years there will not be enough to go around. The United States produces something like 60 percent of the world's petroleum, but our experts warn us of a rapidly waning production. Unlike the metals, which may be reworked over and over, especially the precious metals, whose usefulness may be indefinite, petroleum flares up once and passes away forever. The age of petroleum, in which we now are, will some day be only a memory. But now, supremacy in commerce and in war, on land, or sea, in the air, and under the sea, depend on it. To whom is it most essential? To Great Britain. If Britannia is to rule the waves, if the sun will always shine on the British flag, she must have oil for her merchant ships and her navies. She became aware of this long before the war, and throughout and since the war has acted on the emergency with that strong governmental efficiency and logical foreign policy to which the United States is a stranger. To that end the British government has gone into commercial partnership and became the controlling owner in the great British oil companies; while in the United States the control is in the hands of purely commercial interests, operating without the control, assistance or, at least till recently, sympathy of the government. Quite recently, since the facts of Britain's campaign for oil power have been made known, there is reason to believe that the State Department has been in sympathy with the efforts of American commercial oil interests to compete in the race; but with the dismissal of Secretary Lansing, it is altogether unlikely that this attitude will continue.

In the Eastern hemisphere, British petroleum interests easily dominate. The British government controls by direct ownership of a majority of the voting stock, the Anglo Persian Oil Company, which gives it a monopoly of the Persian field, through a concession from Persia; and through ramifications of this Company, the British government is extending its hold to other parts of the world. In Mexico, which is now second in production, American capital controls two-thirds and British and British-Dutch interests one-third. The general policy of the British Empire is to restrict operations by foreign capital. Such restrictions by government regulations exist in Australia, Canada, India, Barbados, British Guiana, British Honduras, Trinidad, and other colonies.

While American companies may not own or operate oil lands in the British Empire, in the French possessions, or the Dutch Colonies, there are no American restrictions on foreign ownerships or operation. The United States has no settled program of imperial extension, like Britain, but she has her Monroe Doctrine. If she is to retain this—and she seems very firm in it—she must understand the laws connecting commercial and political control, and she must define her policy not only in terms of territory but of petroleum.

Our other great fuel factor, coal, is not so much a matter of centralized commercial control and the object of commercial combinations as it has been the bone of bitter contention between the great commercial nations. With this has gone the problem of iron, the conjunction of the two meaning steel, the backbone of industry. I pointed out in the beginning that the long struggle for the border provinces between France and Germany, as well as the rape of Belgium, has been a struggle for coal and iron; and that the contest between Poland and Germany for Silesia is a contest for coal.

As in the case of petroleum, the United States is wonderfully endowed by nature with coal, having half the world's total supply in reserve. England has also been fortunate, with high grade coal close to seaboard. Note how these conditions operated to determine history, future growth and governmental policies. The American coal is not very close to seaboard, hence that of England has controlled the export trade of the world, and worked with her peculiar role of a world trading nation. The great industries of the United States have left her little coal for export; but it has, with iron and other resources, built up her internal manufactures, wealth, population and power. A philosophic geologist, a student of political and commercial geology of sufficient penetration, from the above geological data (England's high grade seaboard coal and lack of iron, and America's lack of seaboard coal, but wealth of internal coal and iron) might have foretold a hundred years ago, Britain's extension of empire and forceful foreign policy; the disappearance of our merchant marine; the low grade of our diplomatic service; why if an American is in trouble in Mexico he has to appeal to the British consul and the group of irreconcilables who are against the Peace Treaty.

Aside from America and England, there is no dominating factor in the future control of the coal industry in the lands surrounding the Atlantic Ocean. Germany was a strong factor before the war, but the loss to France of the Saar coal district, and the possible loss to Poland of the field in Silesia, will deprive her of her importance.

In the region of the Pacific Ocean, however, the most important future factor is the coal fields of China, which have large reserves of high grade coal ready for development and not far from ocean transportation. The reserves of the higher class of coal in China are surpassed by those of no country but the United States. On the other hand, the high grade coals of the United States are remote from the Pacific Ocean, and could only be available for Pacific trade by the long route of the Panama Canal. It is not unlikely, therefore, that Chinese coal may be in the future supplied to our own Pacific ports by the Japanese at a less price than American coal can be put there, and that through this development Japan may be able to dominate the Pacific trade, as England has dominated that of the Atlantic and the Pacific in the past. Japan already controls a part of the coal produced in China.

For a world power, the establishment of a chain of strategic bunkering ports is necessary. England has developed such a chain, reaching all over the world. The United States has no such system, nor has France or Japan; but for the protection of a great mercantile marine they are necessary. In other words, a great foreign trade, a large amount of export coal, and widely scattered bunkering stations are things which properly go together.

As in the case of coal, no world-wide or even nation-wide monopolies of iron ore have been organized. The greatest single organization in the world is the United States Steel Corporation, furnishing about half the total American production. However, this organization is not a monopoly and there are a large number of powerful independent companies. More than one-third of the world's total production of iron ore has come from the United States, the Lake Superior district alone producing over 30 per cent of the world's total. The Lorraine fields, on the border between France and Germany, have produced 25 per cent of the world's production. Together the two districts produced over half of the world's total.

Japan has an iron and steel industry which is small as compared with the United States, Germany and Great Britain; it is rapidly expanding however, and blast furnaces and steel mills are being erected in Japan, and in Korea, Manchuria and China by Japanese interests. Japan is still very far from supplying her own consumption of steel.

Another feature of commercial geology of importance to hold in mind, is the control by ownership of great iron fields of South America by English and American capital. The Brazilian are among the most important in the world.

Summing up the world's iron and steel situation, the United States has a greatly preponderant position which it will tend to increase, and the growth will have the desirable tendency of drawing North and South America closer together. In Europe, France and Germany are oddly yoked in the control of the second greatest steel industry in the world. In the future great arena of the Pacific, Japan is patiently building up her steel industry, with far-reaching oriental vision. Coal and iron blast furnaces were among the German "rights" recently acquired by Japan. Will Japan return Shantung? Did Germany return Alsace-Lorraine? What will be the result of the American pressure for Japan to give up Shantung, combined with her need for the Philippines? What feelings will grow up, and how will they mature? Does not the Senate know that Japan has formulated a Monroe Doctrine of the East, which she dares not announce; and how does she feel that she dares not put herself on an equality with the United States and announce it?

As for the ferro-alloy metals, manganese does not provide, so far, any striking problems of either political or commercial control, although of interest for the student. The world's supplies of high grade manganese are mostly drawn from Russia, India and Brazil.

Chromite has a more special interest. During the nineteenth century the main source of the world's chromium shifted successively from the Ural Mountains in Russia to the Eastern United States; thence to Asia Minor; and now is divided between Rhodesia and New Caledonia. Due to a series of commercial combinations which I shall not describe, the world's chromite supply is essentially a monopoly, controlled by British-French capital; and the chief supplies occur in the colonies of England and France. In other words, commercial and political control coincide. In the United States, the chrome industry is highly centralized, one company having a monopoly of the ferro-chrome industry, and another preponderating in the chemical chrome industry.

Nickel is likewise entirely controlled by Britain and France, through deposits in Canada and New Caledonia. Essentially the former controls everything. American capital previously had a dominant commercial control, through ownership of the largest ore-reserves and its control of smelting and refining plants in the United States. The British government has had a great light on these problems, and has taken steps to overcome this commercial domination, by establishing a large producing company at Sudbury, in which the government has a controlling interest, and by compelling the transfer of refining operations from New Jersey to Ontario.

The demand for tungsten was and will again be acute; and during the war a great deal of feeling on the part of Americans was developed by the aggressive policy of the British government in securing this in China, Bolivia and Portugal.

Vanadium is completely controlled by American capital, through ownership of mines in Peru and Colorado. The present ownership is allied to the Bethlehem Steel Company.

Antimony, of which more than one-half is produced in China, is now controlled in China; although previous to 1914 the commercial control was secured to England through selling arrangements.

Molybdenum is probably of coming importance. The United States has in Colorado the chief deposits in the world, although they are largely under ownership probably ultimately German. Before this discovery Great Britain was the largest producer; and both the British and Canadian Governments showed much interest in the development of Canadian molybdenum.

Uranium and its co-product, radium, are mainly produced and controlled in the United States, from the Colorado and Utah deposits.

Let me now pass briefly over the great non-ferrous metals, copper, lead, zinc, and tin.

The United States produces 60% of the world's copper output, and in part through control of refineries controls 78% of the world's production. Five leading commercial groups are in control, all American. Interests predominantly German before the war, and still with German affiliations, have been influential in the copper business of the United States, and increasingly so in Mexico. South America is the second largest copper producing continent; with American control predominant, although French, British and German capital are well represented. Three quarters of the world's copper comes from the Western Hemisphere.

The commercial organization of the lead industry is interesting. Germany built up a closely knit lead combination—the famous Metallgesellschaft or so called "octopus," from its many ramifications, which extended all over the world. In attacking this combination, as one of the results of the war, both Great Britain and France adopted the same system of government controlled combination or monopoly. In England this took the form of a British Metals Corporation, covering not only lead but other metals. "Its purposes are to finance British non-ferrous metal companies, bring all the production within the Empire under one marketing organization, and preserve British control." In France the organization is known as the Société Minerales et Metaus. The official announcement states that the Society is organized under the auspices of the French government in order to group the French metal producers operating both at home and abroad, into a cooperative association for the purchase and sale of metallurgical products.

Therefore of all the great powers which are the principal factors in the lead industry, the United States is the only one which does not possess a government controlled lead monopoly as a protective measure against such combinations as regards export trade, the Webb law was passed; but this has been taken advantage of only in copper by the organization of the Copper Export Association. In America, the chief commercial factor in the lead industry is the American Smelting and Refining Company, dominating the market through its control of reduction plants.

As regards zinc, we find that it occupied, before the war, an extreme position among the metals, in that political control or state sovereignty exercised only a minor effect on the industry. Economic factors made ineffective any control not international in scope. A very large percentage of the zinc ores of the world were transported from the country of production to another for treatment; in some cases even being re-exported. During the war, however, political control was largely invoked to strengthen and restore commercial control to the chief belligerent nations, especially in the British Empire, where aliens have been eliminated, and the government retains a share in the control, through interests in marketing organizations and reduction plants. In zinc, as well as copper and lead, commercial control has been determined more by marketing organizations and control of reduction plants than by state sovereignty or mine ownership. The ambition of German interests to control the metal markets and resources of the world was more nearly realized in the case of zinc than in that of any other metal. As the result of the British and French government-controlled organizations, above described, British domination of the European zinc industry seems certain. Should Germany lose Upper Silesia, she will become a small factor in the zinc industry of Europe. With so many doors closed in her face by the British and French political and commercial combinations, there should be precautions taken by the American government that she should not reestablish herself in the United States, nor following out to its logical conclusion the Monroe Doctrine, in the rest of North and South America.

Tin belongs to a group of minerals that are classifiable together from a standpoint of international commercialism, by the fact that they are not of widespread distribution, but are found in really commercial quantity only in a few spots of the globe; and yet are absolutely essential to our industrial civilization. Such also are chromium, platinum, potash salts, nitrates, and nickel. It is noteworthy of this group that the United States is not the lucky holder of the first prize in any of these cases. The United States produces practically no tin, but consumes over half the tin of the world, and is the largest manufacturer and distributor of tin products. Nearly seventy per cent of the world's supply comes from southeastern Asia and neighboring islands, and one-fifth or more from Bolivia. The tin industry is, however, British controlled. In Southeastern Asia the Dutch mines are operated by Dutch companies with British affiliations; and the Chinese mines are controlled by British buying monopolies. The tin smelting industry is also British dominated, nearly sixty per cent being under British control. American smelter interests are combined with British and Bolivian interests, so that they represent part of the British control.

The important mineral aluminum is in the hands of very few producers. In the United States and Canada, the industry is practically controlled by one Company, the Aluminum Company of America. The French producers have a central organization through a selling company, L'Aluminum Francaise; and the sole producer in England is the British Aluminum Company.

Passing lightly over quicksilver, of which the world situation is dominated commercially by the British Government, through a selling arrangement, we may just pause to refer to magnesite, formerly mainly controlled by Austria, but now found in large quantities in the northwestern United States; and to graphite, of which the supply for crucibles is mainly from British and French colonies—Ceylon and Madagascar; while amorphous graphite, for commoner uses, comes chiefly from Austria, Mexico and Korea. Mica of the better kind, essential for electrical work, comes mainly from India, to the amount of about 65 per cent of the whole; the British Empire producing altogether 75 per cent. Before the war, Germany had obtained a large measure of control in the Indian mines, and threatened to dominate the mica market of the world. A permanent British monopoly of the market can probably best be obviated by the development of the Brazilian field by American electrical manufacturers.

The most important supplies of asbestos come from Canada, which produces about 85 per cent of the production of the world. The United States is by far the largest manufacturer of asbestos products.

Regarding the group of fertilizer minerals, the essential facts are fairly well known. Of phosphate rock, the United States possess by far the largest reserves; the other large deposits being controlled politically by France and Great Britain, the former controlling the deposits of Algeria and Tunis, the latter those of Egypt. Germany will be without a source of supply under her own control now that her colonies have been forfeited. There is no probability of a world monopoly.

The situation regarding potash is very well understood. In her control of the world's chief potash-deposits, Germany thought herself in possession of a weapon whereby she could demand from the world what commercial concessions she wished. With her political collapse, however, her potash monopoly has gone. Vast deposits of Alsatian potash have gone to France. A commercial combination between the two, and including the Spanish deposits is, however, not at all out of the question.

As for nitrates, it is known that the only important source of natural nitrates is Chile, where the deposits are controlled by British, Chilean, German and American capital. The artificial manufacturer of nitrates by fixation and as a by-product progressed far in Germany, and was attempted feverishly in the United States during the war. In the United States about five-eighths of the nitrogen consumed has been from various organic sources, including the by-production from coke-making, which forms about one-eighth. The remaining three-eighths of the supply has been largely furnished by Chilean nitrates.

In closing, I am not going to formulate a peroration or draw any general deductions. I have hinted at some of these as I went along. But if I have interested you in the subject of the relation of descriptive geology to commerce, politics, war and history, I shall be satisfied. May I trespass a minute longer to explain to you the history of this investigation, concerning which I have given you some sketchy points. I found, when I went to Washington, during the war, to see what I could do, that one of the things our Government officials should know, but were much in the dark about was the sources of supply, and the ultimate control of these mineral supplies so essential to the war, as well as to peaceful industry. Having outlined a scheme for investigation and report, I enlisted the services of many experts, mainly from the government bureaus or emergency boards, each of whom undertook to cover the mineral with which he was most familiar. This service was purely voluntary. The pamphlets were gotten out in mimeograph form, as fast as completed, and distributed for government use only. They were very highly prized. Among others, I am informed that Mr. Lansing took the whole set in his trunk when he left for Paris. On the termination of the war it was thought best to disseminate these studies further. The available copies were all distributed; after which I recommended the publication of all in book form by the Interior Department. Various difficulties came up in regard to this; and it was finally decided against by Secretary Lane; but permission was granted for outside publication. After a vast deal of editing, and the addition of new studies, the collection will now be brought out in book form. Any royalties will be devoted to some public cause; I shall favor providing funds for students at universities, to make studies on political and commercial geology, historical and prophetic, with deductions and recommendations as to present policies. I am also of the opinion that an expert in this study should be one of the permanent officials of our State Department.

Mr. Church.—Mr. Spurr's paper presses home the thought that the subject of the evening is not only an engineering responsibility of the Society and the Section, but is also a civic duty. The Section is fortunate this evening in having as its guests two members of the United States Geological Survey. I am going to ask the Chief Geologist, Mr. David White, to open the discussion.

Mr. White.—A preeminently merited tribute is due Mr. Spurr. In the early days of the war he came to Washington and pledged his services, which became more and more valuable and of far-reaching importance to the country as the war went on. I see here others also who took part in the arduous and sometimes disheartening efforts of that period. Mr. Spurr seemed to be one of the comparatively few men in Washington who had the vision not only to diagnose some of the complicated commercial problems centered about the control of the world's mineral deposits, but also to formulate constructive policies for consideration in the world's readjustment following the war. If the results of the work of Mr. Spurr and his associates are not evident, it is not due to any lack of sound judgment, justice or wisdom. The broad economic and philosophical scope of his conclusions and the statesmanship of his perspective are apparent in the paper to which we have just listened.

To hear a discussion like this is refreshing and to know that there are so many men in New York—all missionaries in this cause—who are profoundly interested in these problems is reassuring. I came here with a feeling that the public including mining men and the Government is in a state of mental paralysis and that in the cases of the public and the Government there is added moral impotency. Perhaps this stricture does not apply to mining men in New York. Nevertheless does it not seem that mining men in general are lethargic and either unaware of or indifferent to the crisis of the present moment as it affects the mineral interests of the United States?

The United States, more than many of us realize, has, so to speak, grown to fit its shell; in fact, at certain points it seems already to have outgrown its domestic limitations. The migration of young farmers to Canada which has for some years attracted slight attention is in evidence. Our country is no longer able to give farms to her returning soldiers, and the lands that are worth taking and paying taxes on are already allocated. Occasional tracts are irrigated at increasing costs and at more infrequent intervals. It may be added that our agricultural lands not only are allotted but that in general they are, in many regions, becoming less productive. Unless the value of the intensive cultivation of small tracts can be shown to our young men they will leave American farms in larger numbers and that balance of trade which has been so largely based upon the exportation of agricultural products will be still further diminished. The difficulties of making good the difference through the increased exportation of our irreplaceable mineral products must be evident to you more than to any other class of our citizens. This nation has outgrown its petroleum resources and without really being aware of it is dependent on the rest of the world for increasing proportions of its oil supply. The supremacy of the United States in the petroleum industry is soon to pass from us.

Mining and metallurgical engineers may not need to be reminded that while our domestic production of some of the metals, such as copper and silver, will be adequate to meet our own requirements, the position of this country, i. e., the supremacy of America, in the control of copper is likely to be lost in the course of 10 or 15 years, perhaps, if the American mining man does not strengthen his position by the acquisition of concessions in foreign countries now opening and urgently inviting development. It is my impression that bonanzas have not been discovered in this country for 20 years and that our metalliferous regions may be regarded as having been well combed by the prospector with the assistance of up-to-date science in geology and engineering. In some lines of mining we are now running on a basis of economies, of improved methods of treatment, and of larger recoveries of smaller values with success dependent upon the magnitude of the enterprise and the efficiency and economy in its management. Thus, our prosperity is to become more dependent upon foreign metal deposits as well as upon foreign resources in timber and oil. The fatuous complacency of the American public which contents itself with saying that the United States has everything it wants or ever will need is one of the most menacing evils of this dangerous period.

Referring to Mr. Spurr's statements regarding coal and iron ores: You will recall that in the early period of the World War, while all neutral nations were facing toward Europe, China surrendered to Japan concessions and privileges which, combined with the rights carried in the Shantung agreement, make available to the iron men of Japan 400,000,000 tons of self-fluxing iron ore of 45 per cent grade, and 1,000,000,000 tons of coal, with the railroad to the coal field and permission to extend railroad transportation in due time to a second or even a third coal field. Add to this the control of the deep water port, the New York harbor, of North China. It requires no great imagination to picture the early development in China, under Japanese auspices, of an iron and steel industry that will not only supply the current requirements of Japan, including the construction of her merchant and war ships, but will also serve as a basis for a destructive world competition extending to our own country and probably resulting in a protective tariff on iron and steel for the benefit of the American wage earner. Does any one doubt the probability that iron and steel produced at excessively low cost in China will in due time appear in San Francisco and other western points at prices which cannot be met by American steel producers? There is only one way really and effectively to protect the United States—meaning the iron and steel people—and that is to follow the example of Japan. According to information received from reasonably reliable sources there remain perhaps 350,000,000 tons of the same grade of ore in the same region of China. There is an abundance of coal in the country and much of it is on navigable water. Further, the search for war minerals, necessitated by the requirements of the World War, has resulted in the development of important deposits of tungsten ores in China, and discoveries of manganese are reported. Would it not be wise for the American steel men, taking advantage of the exceptional friendliness of the Chinese to go to China and enter into partnership with the Chinese for the development of an iron industry under American direction in China? This would be attended by the building of railroads, the establishment of industries, and the promotion of prosperity in China as well as in the United States. This should be done in the spirit of cooperation with China. Certainly our efforts would carry no suspicion of imperialistic purposes. The building up of the foreign trade of the United States, the assurance of holding our foreign markets, and the cementation of friendship with a numerically powerful ally would be by-products in the reward of virtue as well as of business sense. The psychology and customs of China should be studied with consideration. She wants us to come. Her good will is an enormous factor in favor of our nationals and insures an active cooperation and hearty sympathy on the part of her people which may be depended upon to overcome some of her reactionary instincts against the ways of the Occident. It is conceivable that under the propitious circumstances American brains with American ingenuity, initiative, efficiency and vision will be able to establish a steel industry in China that will more than hold its own. Probably this can never be done better than at the present moment.

Some of you will presumably discuss the importance of extending other mineral interests into other countries, as Capt. Jensen will doubtless urge in the case of copper. These are matters of self-preservation. They are not merely questions of profit-making. The need is for insurance now against unfavorable days that are coming when our partially exhausted deposits, from which the best has been used, will gradually have come into drastic competition with bonanzas and deposits of far greater richness than our own to be opened up with lower costs of production in other parts of the world. American capital must be alive to these problems which are to be regarded from the standpoints of protection as well as of opportunity, and it lies with the mining engineers and metallurgists to awaken it and direct it. The race is already on, and if the American mining man is not in it immediately he will lose much of his present advantage. This cannot be too strongly emphasized. With pockets filled to overflowing and with an exchange greatly in his favor he should be as bold and as able in seizing some of the splendid chances now inviting his attention during this period of political and economic readjustment following the war, when the debts of the war-ridden and weaker nations must be paid from their products of their labor and of the ground, as are his rivals in the tax-ridden, unsettled, and nearly bankrupt countries of the nations which a little while ago were our Allies and are now our most aggressive and partisanly nationalistic rivals for commerce and commanding positions in the mineral industries.

Reference has already been made to the danger confronting the United States, by reason of the approaching exhaustion of its petroleum deposits, while the reserves of the rest of the world remain so largely untouched. In the matter of petroleum in particular, not only must the oil companies exert themselves to the utmost, but the Government must also cooperate if they are to be successful, and if the future of the country with respect to adequate supplies of oil, as long as other nations have plenty, is safeguarded. Effective assistance from governmental sources is indispensable, even if it be worth a politician's life to say a kind word for an oil company. A bill has been introduced in Congress, which, in the spirit of reciprocity, aims at the maintenance in other countries of the open-door policy, which is universal and traditional in the United States. This measure deserves the interest of this Society. In connection with the need for it, it is suggested you review the statements by Messrs. Manning, George Otis Smith, and Requa, introduced by Senator Phelan into the Congressional Record of July 29, last; the last Annual Report of Franklin K. Lane, the Secretary of the Interior, and the statements of Mr. F. Mackay Edgar, a British economist, in the September number of Sperling's Journal. The latter, after reviewing the record of American generosity and profligate waste of forests and mineral wealth, including oil, predicts that ten years from now America will be buying 500 million barrels a year from British oil companies in order to sustain our industries, our prosperity and our standards of living. Whether Edgar's prediction will be completely fulfilled remains to be seen, but we are already dependent on foreign oil, in rapidly increasing amounts, and there is no shadow of doubt as to the necessity, at a later date, of buying British oil to satisfy our requirements.

There is no other great mineral commodity in which our situation is so dangerous as it is with oil, but the lessons of our petroleum experience should warn us to take steps for insuring our position with respect to other mineral supplies. I can not too earnestly urge you to consider this question. If you are miners yourselves, or if you have friends, associates, or clients who are mining capitalists, I would have you warn them to sieze the opportunities now being presented for the acquisition of rich and extensive deposits in foreign fields. In this post-war period of opening of countries, in the spirit of progress and development and of a new order of things in the newly organized and less developed regions there are unrivalled opportunities most intimately associated with, or even coincident with, equally apparent duties. American mining men can afford to take some chances even in Bolshevik Russia. It is difficult to understand why American capital is more timid and reactionary than British or French capital. Read the London papers for advertisements of developmental opportunities and concessions in Russia and other countries. Presumably there are, of course, more hazards connected with metal concessions in Russia than in the establishment of a lumber industry, which should be readily feasible, but if the British and French can make the enterprises successful, how about the American? Let us hope that the American mining man will make the venture and that our copper, gold, and silver, as well as our oil interests, will now be greatly extended in foreign lands with profit to the investor, with aid in the development of industry and prosperity in the countries involved, and with great benefit to American industries and foreign trade.

Captain Jensen.—Gentlemen, I was not so fortunate as Mr. Spurr and the other gentlemen present during the war as to be in the Interior Department or in any of the other Government work on the boards, I was busy at that time with machine guns, but since being discharged from the hospital I have come to the Survey and have been devoting my time to a study of the copper production of the world.

Speaking of the Monroe Doctrine, I think Mr. Spurr made a very pertinent remark about this doctrine. It has been held up ever since its inception as something that must not be violated and as purely a political matter, something that was one of the inalienable rights of the United States, but as Mr. Spurr pointed out sometimes commercial interests have something to do with the establishing of political forces. Just at present additional American commercial interest in South American properties would have a great deal of influence in establishing the destiny of the Monroe Doctrine. Perhaps there is no better way in the world of cementing the union of the North and South American countries than by mutual dependency of the two continents upon each other, and certainly that is the one way of making the Monroe Doctrine thoroughly acceptable to both North and South America. Of course, the American capitalist has already done a great deal in South America in the way of controlling its copper output. I suppose Mr. Yeatman and other gentlemen present will agree that perhaps in the case of Chile at least the development of South American copper is only begun. That is true of other countries. Other countries have copper perhaps in greater quantities than we imagine. We have gone along for a long time in the United States knowing that we were the dominant factor in the copper markets of the world, not taking into consideration the time when we perhaps might not be.

Some years ago, I do not remember exactly when it was, but when the conservation of national resources was being given so much attention in this country, a group of specialists determined the life of the American copper deposits. Under the marketing and mining and the metallurgical conditions of that particular time, it was estimated to be about thirty-eight years. Of course, since then the price of copper has risen and methods have improved, hence that estimate has been very greatly changed. I only quote it to make the point that no matter how great our resources in copper are they are not limitless and so long as they are not limitless we must accept it as a fact, and now is the time, if we are going to retain control of the copper industry in the years to come, to acquire some interests in foreign deposits.

Just recently it has come to my attention that competent engineers have examined copper deposits in Formosa and determined their extent and quality as capable of producing at least treble Japan's present output if not more. One of the more optimistic members of the group of engineers, a geologist, thinks they can easily quadruple Japan's output. This means something to us because of the fact that Japan is making great efforts to modernize her copper industries and even with her old methods, more or less primitive, of mining and smelting copper ores, she is able to supply her own market without any tariff on foreign copper. It simply means that when these deposits are developed there will be perhaps four hundred million pounds of copper from Japan which will be available for foreign markets.

Previous to going into the army I spent almost ten years in mining in foreign countries and I was able to see, at first hand, the efforts of my countrymen in getting hold of the important resources of foreign countries. I saw the British making tremendous efforts to acquire the things that they must have but did not need ten years ago and they have been doing it steadily ever since. They have just about reached the climax now.

In the British colonies alone when conditions become somewhat stable so that production can be resumed on a normal basis they are preparing to and can within a very short time, I think, make a production of something over three hundred thousand tons of copper per year. This is not taking into account the tremendous copper resources that they have gained in Russia in concessions. Speaking of Russian concessions, the British interests, since the recent consolidation of several of the British concerns in the Urals under the Russia-Asiatic, Ltd., find from the latest reports that the situation in Russia is not nearly so hopeless as it appears. They are making great efforts to resume operations and have done so in one or two mines with some success.

I would point out that there are only a few places left in the world where additional copper resources are available, among which are those of China, but more particularly those of the Caucasus region. The French have held concessions there for a great many years, but with typical French methods they have accomplished little or nothing and the deposits remain almost unknown. The Caucasus has, at the present time, a fairly stable sort of government and one that probably will last; at least, it is under some sort of supervision by the British government, and there is not so much danger of Bolshevism under those circumstances. A case that recently came to my attention was of copper deposits which are comparatively near to sea transportation, making them accessible to the copper markets of the world, and more than that there is plenty of coal and water power available. It is a deposit of 150 million tons of ore averaging about 5% copper. It is lying there perfectly open, no one has taken it, no one has done anything with it. It would need a little railroad construction and then would be ready for exploitation. The point is that now is the time, at least, within the next two years. Otherwise, they will be lost to us, if we may judge by the tremendous interest that some of our European friends are manifesting in these things. If we are going to get them, now is the time to do it and we had better take a chance on some of these more or less unsettled conditions than wait until it is too late. Incidentally, as someone before has mentioned, Japan is certainly a commercial opponent with vast potentialities and with the hold she has on China she is becoming much more dangerous every day. China probably has (I quote this more or less from hearsay) copper resources that are very valuable. They can certainly be secured without any particular difficulty and now is the time to get them.

There are many other things of the same nature. If we have lost very largely our control of petroleum and if presently we are going to be beggars for petroleum we must equalize this shortage in some way or other. We can offset our lack of liquid fuel somewhat if we can get control over enough of the metalliferous wealth of the world. We can yet secure copper, manganese, silver, tungsten and several other metals. This will be easier to do than getting oil and now is the time to do it.

The Chairman.—Mr. Ball, may we hear from you?

Mr. Ball.—There are many other people here who can discuss this question much better than I can. I think that we who have tried the foreign game a bit sometimes feel that it is a little hard to work in foreign fields because of a process, particularly noted some seven years ago, which, using geological terms, we may denote as the secondary enrichment of foreigners, by descending grape juice.

It is the lowest form of discussion to simply ask a question, but I wish to ask Dr. White what has become of the bill now before the House requiring an open door to our financiers in the oil game in all countries or else closing the oil fields of the United States to foreign interests which are already in it or which are trying to get into it? Do you know what the present status of that legislation is?

Mr. White.—The bill was introduced in the Senate by Mr. Curtis as S. B. 3334. It attracted no attention at the time of introduction, possibly on account of its title, and was not noticed by the trade journals. In fact, few persons in Washington were aware of the introduction of a bill of such scope and aim. Now that the fact is discovered, a keen interest is rapidly developing and the bill is likely to be drawn out of the pigeonhole and made the subject of widespread and animated discussion. Nevertheless, it is a question whether the inertia and smug conceit of this country can so far be overcome, and the public prejudice toward oil corporations sufficiently removed, to open the way to any effective action on the part of Congress for the protection of our future as to oil. The seriousness of the situation is instantly realized when it is remembered that the oil reserves of the United States would, if they could be extracted with sufficient rapidity, supply the country, at its present rate of consumption, for only about 18 years, whereas the rest of the world, which produces only a third as much oil as does America, and which uses but little more than one-fourth of the world's annual production, probably has oil enough, according to an advanced forecast made by Mr. Eugene Stebinger of the U. S. Geological Survey, to meet its requirements at the present rate for perhaps two centuries.

Mr. Ball.—Mr. Chairman, I can not conceive of any piece of patriotic work that the Society can do and a work of more importance from the technical standpoint than to see that every pressure is brought to bear to push this bill so that the door to American interests in the oil business will be opened.

Mr. White.—May I just add one word? That bill applies to other minerals outside of oil in similar terms.

The Chairman.—The discussion so far has put the problem up to us very sharply and we have now arrived at a concrete suggestion of action. The discussion is general and the subject is well worthy of a very full general discussion.

Mr. Addicks.—Just a word to offset the general anti-Japanese attitude which it seems to me has become a national inheritance of all Americans and I do not think it is quite fair. We all seem to take for granted that Japan is a rascal and that anything Japan does is contrary to our interests and we are very apt to magnify this to a point where it is not quite fair play.

We must remember that Japan's experience with the white man has been rather, from her point of view, unfortunate. She won her Chinese war, she won her Russian war and yet she might say that she was almost cheated out of the results of victory in both cases, and I think Japan is justified in having an opinion of the white man that is practically the same as our opinion of Japanese. So we must remember that when we try to construe Japan's actions that she has probably reached the point where she feels that she had better take care of herself and not bother about the other fellow and that what Japan is doing in China today is from her point of view justified if we put ourselves in her place. If we had mineral deposits near at hand and we needed coal and iron, is not it the first thing we would do, both diplomatically and financially, to get the control of them? Therefore, I am arguing that we should meet the thing fairly and at least give Japan the same show that we should give to ourselves.

Mr. Knox.—I apologize for drawing a red herring across the path of this discussion, but there is a question I should like to put before it proceeds any further. First of all. Captain Jensen mentions a mine of such importance recently discovered in the Caucasus that perhaps he could tell us a few more words about it. If I understand him, he says that 150 million tons of 5% copper ore have been measured up. That is prodigious mining, indeed, since it must have been done since the war began and done under most adverse conditions.

As I desire to ask another question perhaps the Chairman would be good enough to put them alternately. I would ask Mr. Spurr where the Germans got their copper during the war, if he can throw any light on the mystery of how a country which up to 1914 produced 25,000 tons annually could during the war consume annually—I forget how much it consumed in units of 100,000 tons?

Captain Jensen.—I have here a few lines of a description of the particular deposit mentioned. It has been examined by two different groups of engineers recently and there is a difference of opinion on it.

It is located in Tchorok Valley. It is one of the principal mineral districts of the Caucasus. This district contains a second group of copper deposits some sixty miles in length. The entire district is highly mineralized. The deposit in the valley of the Murgul river is by one group of engineers reported to contain 150 million tons of copper ore averaging about 3.5% copper. Another group of engineers which recently examined it (French engineers) have estimated it to contain a hundred million tons of 4.4% copper. This deposit is very similar to the American porphyries, consisting of both veins and copper minerals disseminated through intrusive rocks, and in some cases extending into the older sandstone. It is undoubtedly the most important deposit of its kind in the zone, but there are many others of considerable importance in the district, all of which lie within approximately sixty miles of the seaport of Batum on the Black Sea, or in the valley of these two rivers somewhere near the Tiflis Kars Railroad.

There has evidently been no concession given covering this deposit and it seems to be from the latest advices that I could get through the State Department still open to anyone who will take it. The government (the new republic of Georgia) is under some pressure from French or British interests and it may offer some very fair concessions. This is perhaps the most important of these deposits in this region but that isn't the only one. There are three other districts in which a great many deposits occur of varying size and importance, any of which, however, I think might be worthy of the attention of American engineers. Out of the number there should be some that should be of commercial value.

Mr. Spurr.—The question Mr. Knox asked is one that we asked of ourselves during the war, not only regarding copper but regarding the other metals that we knew Germany must be short of. We really at the end didn't get any satisfactory data as to what the production was or where it came from. The principal deposits of the Mansfield works were worked to the limit, and of course expense was no object when they were paying in paper marks. Reports came to us that they were working deposits at Mansfield of ½% copper. They did open, I understand, some of the old deposits in the Balkans, small deposits which had not been worked for a long time. They opened them up and got a certain amount of ore regardless of the grade. It is generally supposed that Germany received a great deal of smuggled stuff from the north, from Denmark and Sweden, and that material was obtained in various ways. I don't know how much that amounted to, but it couldn't have amounted to very much altogether, because it is quite certain that Germany ran very short of copper and other things and she had to devise substitutes for her copper. Of course, in her electrical work toward the end she substituted aluminum, and all sorts of substitutes for the other uses of copper, iron or any other metal she happened to have, and of course she scraped together out of the empire and the tributary empires all the copper she could get. I don't know how much she cleaned out of Turkey, but there was an immense amount of copper in Turkey in the shape of kitchen utensils and so she made out the best she could, but toward the end she must have been absolutely out of copper, even by working over and over again all her old scrap.

Mr. Meissner.—Mr. Chairman, last night at the meeting of the Mining Engineers the question came up seriously as to doing something in reference to similar bills, and now we are advised that all engineers should do something about them. In what way are we doing anything about them? We are all talking about them, but in what practical way are the societies or the individuals doing anything to bring these matters before their Congressmen, before the Senators? I'd like to ask the question.

The Chairman.—The membership can supply the answer as to individual action, and I think the Secretary can tell us if any action has been taken on these bills by the Society.

Mr. Sharpless.—The Society has so far taken no cognizance of the bills that have been spoken of tonight.

Mr. Meissner.—Mr. Chairman, I want to make a suggestion from a practical standpoint. Talking about it, of course, is not going to help us very much with our Congressmen and Senators, neither is it going to help us very much to say we should all individually write to them. I have had a number of requests of that nature come to me on matters where I felt it ought to be done. I did not do it. I did not know just how to go at it. I did not know just what to say. Would it not be a good idea for the Society to have a committee which would get up some sort of a letter which would embody just what we want to do, just what we want to have, to embody that which Mr. White speaks of, and put that letter before the individuals and ask them to sign it and send it to their Congressman, then also have the Society as a Society put the matter up to Congress? Then you will get some real action. I think every man would be perfectly willing to send out that letter to his Congressman and Senator. It would not be just casual and on the spur of the moment, and they would realize that we really meant to do something.

The Chairman.—If you will permit the suggestion, the problem of getting action from our government in Washington may be solved for the moment by the methods that have been suggested, writing individually and writing as a Society to our Congressmen.

I was impressed very much by a remark of Mr. White's as to the need of education. We need in this country a campaign of education which will remove from the political field the action of our Congressmen on what is a matter of the public interest. The only way we can remove it is by getting the total voting power of the country to understand the economic need of these things and that is a gigantic task. I am using it in the narrow and partisan and selfish sense in which we are interested in this question. A politician now does not dare to, never dares to father or to help along an unpopular measure and those measures are unpopular which the particular political faith or the particular emotional stress of the day makes unpopular. We can not today help a big corporation to expand in what must ultimately be a community interest, public interest, because we have before us always the bugbear of an ignorant, sometimes justified, frequently unjustified, antagonism on the part of the voting public. We have before us engineers who are able to look at this thing from above and not from below. It is a gigantic task to educate the voting public of the United States to allow their representatives to take those measures which we, as engineers, see are necessary. It is not a thing that can help us in the immediate emergency, but it has got to be done and I think that the leadership naturally falls on us. It is worth while thinking about.

Mr. Knox.—There are two ways of handling the matter, of which one is to refer it to the League of Nations and the other is to pass a resolution of the Section which on approval of the Council would be referred to the Society for collective action. I therefore suggest that Mr. Ball present his proposal to the Section in the form of a resolution.

Mr. Ball.—I would move that the attention of the Council of the Society be called to the S. B. 3334 now before the House and that if it sees fit, that it concurs with the New York Section in attempting in every way to see that the bill is passed and becomes a law. Motion seconded and carried.

SENATE BILL 3334.

To encourage reciprocity in trade relations. Introduced by Mr. Curtis, October 30, 1919.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That no citizen or subject of any country which requires by law, regulation, or otherwise any stipulation in any contract, lease, sale, or other agreement, relating to mines or minerals, including petroleum, in the said country or its possessions or dependencies, which prevents or prohibits American citizens, because of their nationality, from being shareholders, or which limits the number of shares which may be held by American citizens in such undertakings, or which, because of nationality, places restrictions on

American citizens holding any position in the company or on the board of directors or similar control body shall be permitted to hold either directly or indirectly any right, title, or interest, in any mine or mineral deposit, including petroleum in the United States or any of its dependencies, or to act on the board or in any managerial capacity whatsoever in connection with any company having any right, title, or interest whatsoever in mines or minerals in the United States or its dependences, so long as the restrictions before mentioned shall remain in force in any law or regulation or in any contract, lease, or other agreement to which the government of the foreign country or any of its officials or representatives is a party.

Sec. 2. That no alien company which by its articles of incorporation or association, statutes, by-laws, or in any other similar manner prohibits American citizens, because of their nationality, from being shareholders, or which limits the number of shares which may be held by American citizens, or prohibits American citizens from holding any position on the board of directors in the company shall be permitted to hold either directly or indirectly any right, title, or interest in any mine or mineral deposit, including petroleum in any part of the United States or its dependencies.

Sec. 3. That if any of the things prohibited in the preceding sections exist at any time beginning two years after the passage of this Act, then, and in that event, the position so held by aliens shall become vacant and any and all acts performed by any such alien connected with such company shall be without legal force or effect and the shares or interests so held contrary to this law shall be sold by the Attorney General to American citizens under such conditions and regulations as the Attorney General shall affix, but always within one year from the time such shares or interests come under the provisions of this Act, and the net proceeds of such sales in each case shall be paid to the alien citizen, subject, or corporation concerned.

Mr. White.—Since a question involving a new national policy, especially one beneficially affecting oil companies is liable to require a long campaign of education, and delay of action on the final question until the attitude of the "folks back home" has been ascertained, it is likely that before this or any other bill is enacted, that the important oil reserves of the world outside the United States will have been very much more fully "sewed up" by our commercial rivals, who are now so industriously engaged in cornering the world's supplies. It is almost futile to hope for the benefits that might be achieved if the bill could be passed promptly The opportunities for diplomatic action and trade agreements compelling open-door policies in the mandatory countries at least, are presumably passing by. There is hardly room for doubt that not only the policies to be adopted in some of the mandatory regions, but even the political boundaries themselves, will be made subservient to the oil ambitions of the prospective protectors. It is in fact not improbable that in some cases rich oil territory in an adjoining country will be seized by the solicitous protector in order to insure the safety of the protected.

Legislation, if prompt and wise, will be of some value to America, but diplomacy of a drastic type may be more effective. Meanwhile, the situation calls for the most prompt and vigorous effort on the part of American mining men. Let us hope that they are not disabled by financial shell shock nor so preoccupied with fear lest their wealth be taken, either by the Bureau of Internal Revenue or the Labor Unions, that they are incapable of visioning the opportunities of a century which now invite their investment in foreign land. To the great ultimate advantage of themselves, their industries, and the country.

Mr. Graton.—Upon this keenly interesting subject, some crude and piece-meal thinking has led me to certain points of view which you may permit me to express. Many are convinced that this is an opportune time, not only to consider the matter of acquiring control of mineral supplies, but also to act toward that end. The world may be said at present to be in a state of flux—a new accounting is beginning. Other nations are acting; no doubt we shall lose opportunity, perhaps wonderful opportunity, if we let this period slip by us. It is evident that we have needs; we have needs even in those directions where our security might seem greatest. We are smug and complacent about copper, for instance, apparently content with our present domination of the supply, but as already pointed out, we really haven't too much of that. What we have we have been, in a sense, giving away; we have been selling it but little above the cost of production without adding in the cost of the raw material—like selling shoes without charging for the leather.

To acquire the things we need, we must first, of course, realize what those needs are and where they can best be filled. I feel, therefore, that we are deeply indebted to Mr. Spurr, both for the initial conception of this broad subject, which started this inquiry in Washington, as well as for his presentation of the whole problem so clearly before us to-night.

I am inclined to share with Dr. White, however, a spirit of pessimism with respect to any materially important action being taken in the near future by this country; I am afraid that my pessissimism goes even further than his. I have come from a short sojourn in Washington which, as you know, is a place where it is easy to acquire pessimism. I do not like to contemplate the dark side of things, but we may as well look squarely in the face one or two features of this subject.

It seems to me that the American government, the American business man, and the Americans in general are strong on processes, but weak on policies, and especially are we deficient in our relations outside our own borders. We have no foreign trade policy; we have no shipping policy; our present financial policy avails us little abroad; we have no colonial policy, although we now have dependencies; we certainly have no mineral possession policy, either as a nation or as individuals. Such efforts in this last field as have been made on private initiative have either succeeded wholly through their own efforts, plus good luck, or, if they have languished, they have been left to their own resources and devices without sympathy or support from our government. The business man who has thus burned his fingers, or seen others burned, hesitates to embark on an enterprise abroad in competition with foreign interests that have behind them the full weight of their respective governments. Dr. White has suggested that the present opulence of American industries renders them well able to take chances afield. Is it not likely, instead, that our corporations are reluctant because of this very condition? They are not obliged to take risks now, and they have everything to lose. The man who has little or who is deeply in debt is the one who can take long chances.

The present aggression and foresight of the British, for example, in contrast with our own attitude in the matter of mineral acquisitions, cannot be ascribed, it seems to me, so much to differences in climatic, racial or mental conditions, as to the fact that whereas until recently we have been nationally self-sufficient and self-contained, England has for generations been obliged to depend largely on external resources and trade. The British have developed a strong governmental policy and an especially strong and effective foreign policy, not because they inherently knew more about these matters than we, but because they had to do so in order to survive. They already have a long start on us, whereas we are not even yet pressed to that necessity which will mother our inventiveness and accomplishment in such directions. My own fear is, therefore, that many of the opportunities that, at least potentially, are on the horizon at the present time are likely to fall largely to others before we, in our extremity, are forced to be effective.

Perhaps I should explain something of the foundation for this rather gloomy deduction. I may do so by referring to a specific instance that came to my attention in Washington some months ago involving the question as to whether this country should maintain its control over certain foreign mineral resources or whether that control should pass to another country. It seemed to me a most clear-cut and important matter—important both because of its own magniture and because of the principle involved and the possible momentum that might be started in the right direction if this particular case could be settled right. I therefore exerted all my efforts and sought to bring such influence to bear as might carry this matter to a satisfactory issue.

The State Department and the Treasury Department were directly concerned. But I went first to the Geological Survey because of its known interest in American participation in foreign mineral industries. As I expected, the Geological Survey was instantly sympathetic and gave every assistance within its power, though this was necessarily rather recommendatory to other Departments than executive under its own auspices. At the State Department, a diversity of view was found. One official, unfortunately in a somewhat subordinate capacity, was keenly interested and alive to the situation and all its significance, but he was but a cog in a wheel that was revolving in another direction.

In the Treasury, most polite attention was accorded, but the attitude taken was that familiar one which is so discouraging and so deadening: "Of course, action cannot be taken on individual cases: if enough such cases should arise to constitute a general situation and to convert the question into a principle, then perhaps something could be done in Congress." No impression was made by the statement that the decision in this instance was a question of days, not of months or Congressional sessions, nor by the suggestion that one important case was enough to raise the question of principle, and that if a single case were allowed to drift to an unfortunate outcome, the principle would be settled adversely once and for all. I am sorry to say that, in contrast to the most aggressive and snappy action by the other Government concerned, this case was decided without the slightest action on the part of our own Government.

While thus inclined to be doubtful as to the probability of any very energetic action just now by American Corporations abroad, and while breathing a deep "Amen" to Secretary Lane's characterization of the sluggishness of our Federal machinery, I feel that those of us who think we see the situation rather clearly must certainly not be content with mere criticism nor become calamity howlers, but instead must exert all effort to improve the situation. For my part, although it does not necessarily concern very directly this evening's topic of mineral control, I feel that a long step in the direction of improvement would be taken and a most illuminating example set if the Public Works Department, now so strongly supported by the engineers of the country, might become a reality.

Mr. Knox.—Speaking of pessimists, I have in my pocket, as convenient for subway reading, an address delivered by Brooks Adams at the Bunker Hill celebration in 1916. Its title is "The Incoherence of American Democracy" and its theme the confusion of thought on public questions. Almost in Mr. Graton's words Adams points out the absence in this country of any national policy or even of any coherent public opinion and with his accustomed historic profundity touches on the causes of the failure. George Washington had the vision to perceive that national unity could reach full development only through physical opportunity, that is through a national university but especially through ready communication between all parts of the Commonwealth and the capital which he sought to establish by canals linking the Potomac with the Ohio and Mississippi and by a system of radial roads providing access to the North and South, thus making the capital city the true heart and brain of the Republic. Washington's great plans languished after his death and finally expired with the development of the railway on purely commercial lines so that today the capital ranks intellectually with a country village, save always for the leadership maintained by the scientific bureaus.

If then the capital fails us as the center of national consciousness, inspiration must be sought from other sources and in my estimation the happiest promise lies in such organizations as our own which can be shaped into nuclei around which will gather those definite conceptions which may develop into coherent national thought and purpose.

Mr. Ball.—Mr. Chairman, I fear one or two of the remarks regarding this Curtis bill may be misunderstood, and I wish to say a word or two in explanation. The present situation, in the oil industry at least, is this: that in the United States any group of foreign capital is at the present time free to enter the country, to buy up oil lands, to start production and sell the production where they will. The situation, at least as far as most of the British and French colonies go, is this: that American capital cannot enter there. It requires predominantly British capital, it requires a preponderance of British citizens on the Board of Directors and it requires British technicians or men nominally British in control of all of the organization. Practically the same thing is true of the French colonies. Once the French and British colonies are taken out of the sphere of

American oil financing, a great share of the possible oil fields of the future are closed to us. The bill only says this or the intent of the bill is this, that if you let us play in your yard then your citizens can continue to play in our yard. The conditions, at least in the oil game, are such in regard to a considerable portion of the world that we can not play outside of our own territory and some portions of South America. The present condition is such, I believe, that legislation is essential and that the financier without legislation can do little, at least as far as much of the world is concerned, therefore I think it is absolutely essential that the Society use every pressure on Congress that it possesses.

Mr. Addicks.—I do not think we ought to break up in this down-hearted frame of mind. While much that has been said about our governmental efficiency is perfectly true, if we apply a little of the doctrine of relativity to it, I think it will show up a little better. In reference to the British policy that has been discussed recently, I might say that the London Times has had for a long time a column headed "The Road to Ruin," in which the governmental problems were discussed. The chief problem seems to be that they are spending twice as much as they are receiving and do not seem to know how to stop it. Take the Irish policy. It does not seem to be very well considered or successful. We have not come out of the war the only nation which is in really bad shape. Is not that rather reversing the truth? The Government's foreign policy I will not attempt to defend, but in its domestic policy I do not believe it is quite fair to say that we are in such a desperate situation. Certainly our Government departments, the various scientific departments that Mr. Knox mentioned, have no equal anywhere. As for example, our Geological Survey and our Department of Agriculture, etc., where there are scientific branches. I do not know any of other countries that parallel these Departments. These incoherent remarks, as Mr. Knox would say, are merely to try and cheer us a little bit before we adjourn.

Mr. White.—The question discussed by Mr. Adams as to whether our form of government and our political organization as it actually operates, or mostly fails to operate, is one which lends itself to the establishment, persistent adherence to and development from administration to administration of any stable, foresighted and constructive national policy, has come to many of us who for many years have watched public affairs. My impression, and I have lived in Washington many years, is that I have known of but two so-called policies of the government of the United States. Those policies are the Monroe Doctrine and the protection of American industries by tariffs. As I see it, both of these policies are more or less distinctly policies of isolation. Our national growth in certain lines is restricted. We must have contact with other nations and such contact means that we cannot live on in isolation. If the American copper producers sit quietly and operate their own mines as waning resources while the uninhabited or less civilized parts of the world, with enormous resources are being developed by others, if we not only lose control of copper but also see copper being produced much more cheaply and in enormous amounts in these regions, we may live to see the day when we will need a protective tariff to keep foreign copper from competing with our mines and to enable some of the mines to live longer than they otherwise would.

One word should be added: The United States Chamber of Commerce is taking up the consideration of some carefully chosen, disinterested, non-partisan, and permanent board who may merit and create a position of influence in the government and gradually lay the foundation for stable, far-sighted, continuing and constructive policies affecting the foreign commerce and relations of the United States. I hope that this very important proposition which I know is now being considered may take form in some kind of recommendations. We need a body having all the good officers and attributes of the British Board of Trade, but without some of its defects. Efforts for the movement are educational with the object of arousing the interest of members of Congress in the present situation and the perils of the hour. It may develop in the conviction that some industries in this country must be helped. I also hope that Mr. Spurr, who is sure to get rich on the royalties of his book, will send copies to all members of the United States Chamber of Commerce—I mean the inner circle at least. He may be able also to send copies to members of Congress.

Mr. Lewis.—I fear we are passing over a little lightly and are liable to lose sight of one important point that has come up in the discussion this evening. This campaign of education that we have been talking about should have a beginning. It is not going to organize itself, and there is not going to be any campaign if we only discuss it among ourselves at these meetings.

Would it not be well to adopt another resolution calling the attention of the Council of the parent Society to the need and asking them to consider the feasibility of organizing some effective means of reaching not only our congressmen, but the intelligent public generally. Apparently the New York newspapers scarcely knew that the city was overrun with mining engineers a few days ago. If it had not been for Mr. Hoover probably all the notices of the A. I. M. E. meeting would have been crowded into an obscure corner of some inside page, in spite of all the high-minded discussions of national and international problems. The political interest that attached to Mr. Hoover's utterances was the only thing that commanded any prominent attention.

May it not be possible to utilize in some degree our highly efficient Government scientific bureaus in an organized effort to reach the intelligent electorate of the country. The people must be made to see beyond the petty political squabbles of today to a broader horizon and, perhaps, to comprehend the necessity of establishing consistent national policies, both internal and foreign. Once organized doubtless other engineering societies would be willing to join in such a movement for public education. We can also count on our highly efficient technical journals, but it will be necessary to enlist the cooperation of the press generally in order to reach the masses of the people.

I suggest a resolution looking toward the inauguration of an effective campaign, not for this year nor for the present Congress only, but as a matter of permanent policy for the years to come and as a part of the general movement to mold the engineering profession of the country into a civic force—to bring the intelligence which the engineers command to bear upon governmental affairs and policies. I move that this problem be called to the attention of the Council of the parent Society in the earnest hope that some effective plan may be devised for its solution. Motion seconded.

Mr. Rogers.—I think probably Prof. Lewis is not aware that there is already such a movement on foot and has been under way for probably more than a year. The engineers of the country generally, as you probably know, have felt dissatisfaction with Engineering Council. Engineering Council was organized very largely to discuss the questions mentioned. The average engineer, however, felt it wasn't a democratic organization, that it didn't truly represent the engineers of the country. As a result of that feeling and also as a result of the desire of the members to inquire into their own organizations, committees were formed in the various national engineering organizations. Out of that grew this movement to form a national civic federation of engineers (it has no name as yet but that describes it), and a general conference committee was appointed from all the national engineering societies. This committee has formulated a plan for organizing this national federation. The plan has been approved by the national societies and the committee is meeting in Philadelphia this week to formulate and issue a call for delegates from all over the country to meet in Chicago in April to form a national engineering congress.

The object of this federation will be to express the engineering opinion of the country in civic affairs, national, state and local. Its working basis will be a congress composed of delegates from local organizations from all over the country which will meet periodically, probably once a year. The Congress will probably elect an executive committee of some considerable size that will meet more frequently for action on current matters. There is also, as you know, the Engineers', Architects' and Chemists' Association, now known as the National Public Works Association, which first met in Chicago last summer on the call of Mr. J. Parke Channing, and which is working for a national public works department, so that, while our Society can very gracefully join in these movements, it will not be initiating anything new.

Mr. Lewis.—May I add just a word? I am aware of this movement to which Mr. Rogers refers, but I did not know that it included a plan for an organized campaign of public education. I had supposed that the principal object was to devise some means for obtaining an expression of engineering opinion on public questions and to make representations to Congress from time to time. We must go far beyond that, of course, if we are to reach the great body of the intelligent electorate.

The Chairman.—Gentlemen, you have heard the resolution. What is your pleasure?

Upon vote the motion was carried.

After a rising vote of thanks to the guests from Washington, the meeting adjourned at 10:45 P. M.

A. P. WATT,
Secretary New York Section.

Mining and Metallurgical Society *of* America

Vol. XIII, No. 3 April–May, 1920 Bul. 139

ANNOUNCEMENTS.

1920 Medal.—The Gold Medal of The Mining and Metallurgical Society of America was awarded on April 20, 1920, to E. A. Cappelen Smith for Distinguished Service in the Art of Hydrometallurgy.

It was hoped that the presentation of the medal could be made on June 2, and announcements were issued to that effect. This date proved to be unfortunate, many members particularly desirous of attending the function having been called away during the month of June. The committee has therefore decided to postpone the presentation until fall, the date to be announced later.

National Department of Public Works.—Whatever may be the outcome of the endeavors of the Committee having this matter in hand, a significant and encouraging development in the campaign is the introduction into Congress of what is known as the "Smoot-Reavis Joint Resolution" (H. J. Res. 339), providing for a joint committee to consist of three members of each branch of Congress to make a survey of the administrative services of the Government, to determine what redistribution of activities should be made among the several services, and what departmental regrouping of services should be made, so that each executive department shall embrace only services having close relation with each other; and to prepare and submit bills and resolutions having for their purpose the co-ordination of the Government functions and their most efficient and economical conduct.

COUNCIL.

Meeting of April 8, 1920.

A meeting of the Council was held at the office of the

Society, April 20. Those attending were Messrs. Lindgren, Westervelt, Yeatman, Ingalls, Penrose, Knox and Sharpless.

The Vice-President, Mr. Westervelt, occupied the chair until the arrival of the President, Mr. Lindgren.

After the approval of the minutes of the previous meeting the chairman appointed Mr. Knox as teller to examine the ballots cast for the recipient of the Society's medal to be presented this year for distinguished services rendered in the Art of Hydrometallurgy. The teller reported that all councillors had voted. The results of the canvass were submitted to the chairman who thereupon announced that the Medal for the year 1920 had been awarded to Mr. E. A. Cappelen Smith.

A resolution from the New York Section was read asking the Council to take favorable action upon Senate Bill 3334, known as the Curtis Bill. This bill was published in full in BULLETIN 138, p. 119.

In substance this bill proposes that the citizens of foreign countries interested in any manner in the ownership of mineral or oil lands in the United States, be accorded the same rights and privileges as accorded to citizens of the United States in those foreign countries.

A discussion of the resolution brought out the fact that the members of the Council thought it unwise to support this bill as printed or any other particular bill now before Congress bearing on this subject, but did think it advisable that the membership should be given an opportunity to express itself upon the principles enunciated in this bill. Upon motion the Executive Committee was instructed to prepare a resolution embodying the principles of S. B. 3334 and refer the same to the entire membership of the Society for letter ballot.

A resolution offered by Mr. Lewis of the New York Section was read. This resolution asked the Council to inaugurate an effective campaign with the object of molding the engineering profession of the country into a civic force.

After discussion the resolution was laid upon the table, it being the opinion of the Councillors present that the Society is at the present time doing of itself and through the cooperation of its members with the members of similar organizations, all that it can do in the direction indicated.

At the request of Van H. Manning, Director of the Bureau of Mines, the Council approved of the appointment of H. V. Winchell to membership in the committee on the Revision of Mining Law which has been named by the Bureau of Mines.

Following up the campaign for the formation of a Department of Public Works or a more economic segregation of National activities calling for engineering service the National Chamber of Commerce called upon its members to vote on the question. The Mining and Metallurgical Society is an active member of the National Chamber. The members of the Council felt that this was a matter of sufficient importance to the members of the Society to ask them to express their views.

Upon motion the Secretary was instructed to send to all members the referendum in the same form as submitted to the Society by the Chamber of Commerce.

The National Safety Code Committee having asked for the co-operation of this Society in drawing up a number of uniform safety codes, the Council, upon motion, authorized the Secretary to advise the Chairman of the Committee that the Society would be glad to review and criticize any codes that properly came within its purview. Among those codes which are to be drawn and in which this Society may be interested, are those dealing with Metal Mining Operations, Uses of Electricity in Mines, Coal Mining Operations, Stone Quarries, Smelting and Refining.

The Society having been invited by the U. S. Chamber of Commerce to send a representative to the inaugural meeting of the International Chamber of Commerce to be held in Paris, June 21, and having been asked to submit subjects for discussion that might properly be brought before such International Chamber, the Council, upon motion, authorized the Secretary to suggest to the proper authorities the principles of S. B. 3334 as a proper subject for discussion.

F. F. SHARPLESS, *Secretary.*

REFERENDUM.

Reciprocity in Mining Laws.

By order of the Council the following resolution was submitted to membership vote on April 20.

RESOLVED—That The Mining and Metallurgical Society of America herewith petitions the Congress of the United States to safeguard the rights and interests of American investors, whether actual or prospective, in foreign mineral industries by providing by statute that no citizen or subject of any country which requires by law, regulation, or otherwise any stipulation in any contract, lease, sale, or other agreement, relating to mines or minerals, including petroleum, in the said country or its possessions or dependencies, which prevents or prohibits American citizens, because of their nationality, from being shareholders, or which limits the number of shares which may be held by American citizens in such undertakings, or which, because of nationality, places restrictions on American citizens holding any position in the company or on the board of directors or similar control body shall be permitted to hold either directly or indirectly any right, title, or interest, in any mine or mineral deposit, including petroleum, in the United States or any of its dependencies, or to act on the board or in any managerial capacity whatsoever in connection with any company having any right, title, or interest whatsoever in mines or minerals in the United States or its dependencies, so long as the restrictions before mentioned shall remain in force in any law or regulation or in any contract, lease, or other agreement to which the government of the foreign country or any of its officials or representatives is a party.

That no alien company which by its articles of incorporation or association, statutes, by-laws, or in any other similar manner prohibits American citizens, because of their nationality, from being shareholders, or which limits the number of shares which may be held by American citizens, or prohibits American citizens from holding any position on the board of directors in the company shall be permitted to hold either directly or indirectly any right, title, or interest in any mine or mineral deposit, including petroleum, in any part of the United States or its dependencies.

The subject of this resolution was discussed to considerable extent by the New York Section and reported in BULLETIN 138, which was sent to members in advance of the referendum.

As a result of the canvas of the ballots upon the above subject the Secretary reports as follows:

One hundred and fifty ballots were returned; of these one hundred and twenty-three were in favor; four opposed and four undecided.

While the foregoing vote is almost unanimous those who have objected to the resolution have given their reasons for the objection and they are reproduced herewith. Members have not authorized the Secretary to publish the notes written on their ballots hence their names are omitted.

——— ————; "I am opposed to the above resolution on the ground that it is inadvisable to copy the bad laws of other countries. An example of the results of retaliatory regulations was the added inconvenience to travelers arising from the passport rules of the United States and Mexico during recent times."

——— ————; "Realizing that the referendum ballot on the resolution will probably be carried by a very large majority vote, and being entirely in sympathy with the spirit of the resolution, I nevertheless am voting in opposition thereto as I wish to indicate that I am opposed to the form of the resolution. I think that it attempts to be much too specific in character and I, personally, would prefer a resolution petitioning Congress to take reciprocal action against the countries requiring by law or regulation such discrimination as is described. The resolution as drafted, if effected, might cause reciprocal action much more drastic than that effected by the country against which it was directed. I think that it should be left with Congress to reciprocate in like measure to the discriminating action taken by such other country."

——— ————; "This must be regarded as a national political question which should be treated on a broad basis and not from the selfish standpoint of interested parties. I think that the Society should refrain from placing itself in the latter category."

——— ————; "I should like to express a criticism of various resolutions recently submitted by the Council of The Mining and Metallurgical Society. My point is that they have been rather arguments than questions; they are stated in a biased manner; a lawyer might call them "leading questions." One may agree with a part of the question propounded but not with other parts. In the case of the recent referendum submitted by the Committee on Economics, I was unable to vote at all. With the greater portion of the resolution, I emphatically agreed, but with some portions I could not. So with the resolution now submitted relative to rights and interests of American investors—it seems to me most unfairly stated, and calculated to elicit an expression of opinion which many members would be the first to repudiate, if the question were viewed from the opposite side."

At a meeting of the Executive Committee of the Council held on May 10, the ballots and letters were canvassed and the Secretary was instructed to report the vote of the Society as favorable to the principle of the Resolution.

The Secretary was further instructed to take such action as was customary to bring this resolution to the attention of those responsible for legislation upon the principle involved.

REFERENDUM.

Department of Public Works.

On April 22, by order of the Council, the following questions were submitted to all members for letter ballot:

I. Shall a Department of Public Works be established by the National Government?

II. Shall a Department of Public Works be established by a suitable modification of the existing Department of the Interior, excluding therefrom the non-related bureaus and offices and by change of name from Department of the Interior to Department of Public Works?

III. Shall a Department of Public Works be established by creation of an entirely new department?

Arguments for and against a Department of Public Works have appeared in the BULLETIN on numerous occasions since May of 1919. The technical press has given the subject much consideration. In view of the publicity that the matter had already been given the council did not deem it necessary to submit with the ballot any of the arguments in favor of or opposed to the three suggestions.

As a result of the canvass of the ballots the Secretary has the following to report:

One hundred and twenty-six ballots were returned.

Proposition No. I.	In favor	103
	Opposed	13
	Not voting	10
Proposition No. II.	In favor	68
	Opposed	33
	Not voting	25

Proposition No. III.	In favor	55
	Opposed	44
	Not voting	27

At a meeting of the Executive Committee of the Council, held on May 11, the ballots were counted and discussed.

On motion the Secretary was instructed to cast the ballot of the Society in favor of the first proposition. It appeared from the ballots that while a large majority of the members favored the establishment of a Department of Public Works by the National Government, there was not a large majority favoring either an entirely new Department or a modification of the functions of the existing Department of the Interior. Hence it was felt that the Society was unable to express a preference for the one or the other, but should leave this detail to be worked out in due course by those who will ultimately frame the bill whose passage will bring about the proposed alterations.

COMMUNICATIONS.

Committee on Economics.—The following appeared in the press of May 8:

> "Not a cent less than $2,500 a year will be acceptable to or adequate for the railroad employees of the United States, the United States Railroad Labor Board was told by W. Jett Lauck, who is appearing for the men in support of their demand for higher wages. Mr. Lauck is a former secretary of the National War Labor Board.
>
> "Mr. Lauck demanded the fixation of $2,500, not as an average wage for the railroad workers, but as an absolute minimum.
>
> "It is impossible, he said, for a family of five in the United States to maintain itself in even decent poverty under existing conditions for a penny less than $2,500 a year. In making this statement I am well within the findings of the United States Government itself, for on the basis of the budget compiled by Prof. Royal S. Meeker, Commissioner of Labor Statistics, dated August, 1919, a family today needs $2,533 upon which to live.
>
> "If industry is to live, the workers must live. Hunger wages must give way to living wages. The needs are not to be determined merely by the lowest possible amount of food, clothing and shelter the workers can exist upon. It is the living wage that is contended for, a wage that will not merely give physical comfort and keep the worker a healthy animal, but one which will supply him with the necessities of good citizenship."

The above may be taken as a text for a lesson in practical economics.

In 1916 there were about 2,000,000 railway workers in the United States and about 40,000,000 workers of all kinds. If $2,500 per annum is the absolute minimum that the worker must receive in order to live decently, the 40,000,000 workers of the United States must be able to draw from a production of $100,000,000,000. In fact the United States does not produce so much as that. If, therefore, the railway workers are able to exact $2,500 per annum, other workers will have to get along with just so much less.

Contemporaneously the workers for the Boston Elevated Railway Co. are demanding $2,300 per annum. In a hearing of this case the director of the State income tax department was called upon to testify. He stated that out of 1,183,000 males working for, or receiving compensation, about 173,000, or about 1½%, have an annual income of $2,000 or more. This led a member of the board of arbitrators to remark that he saw no reason for the people paying trolley men larger wages than the greater number among themselves enjoy.

A fallacy of Mr. Lauck is this: The estimated requirement of $2,500 per annum is for a *family* of five. In 1916 there were about 40,000,000 *workers* and 20,000,000 *families*. In the average the family comprises two workers for wages.

Mining and Metallurgical Society *of* America

Vol. XIII, No. 4 June–July, 1920 Bul. 140

ANNOUNCEMENTS.

Bound Volumes.—On August 1 bound volumes of the BULLETIN for the year 1919 were sent to all members who had subscribed for them. If not received by the time this bulletin comes to hand the Secretary should be notified immediately.

New Mining Code.—A revision of the United States Mining Code is a subject upon which the Mining and Metallurgical Society has done so much work that members will no doubt be interested in knowing the present status of the matter, especially since several contradictory reports have been more or less widely circulated.

It may be recalled that the revision of the Mining Code was one of the first subjects taken up and seriously studied by our members, Mr. H. V. Winchell being particularly active in developing the position of the Society on this subject. Following the discussions which took place in the eastern and western sections of the Society a referendum was prepared and sent to all members for their consideration. On March 30, 1914, certain resolutions, as appeared in the last copy of the Constitution, page 27, were adopted by the Society.

In order that the Society might have the benefit of still wider opinion a questionnaire was prepared and submitted to all metal mining organizations within the United States. The replies from these questionnaires indicated that there were a number of changes which were almost universally desirable, while respecting others there was such a diversity of opinion as would indicate that no change should be made at present.

On December 16, 1915, a special meeting of the Society was held at Washington attended by representatives of many organizations, and resolutions there adopted quite clearly defined the prevailing sentiment in regard to alterations and the manner of making them.

It may further be recalled that the earlier efforts of the Society were in the direction of having a commission appointed to take testimony in all districts affected by the proposed changes. This commission was expected, subsequently, to formulate a bill which would represent, as nearly as possible, the consensus of opinion of those interested in mining, this bill to be presented to Congress for enactment. The resolutions adopted at the Washington meeting, where other societies were represented, included the foregoing plan.

It may also be recalled that the Commission Plan did not meet with very favorable consideration on the part of Congress, but that those who had the matter in charge on numerous occasions advised us to the following effect: "If you gentlemen who are interested in mining will get together and formulate what the majority want in the form of amendments, or new acts which may be passed or rejected, the subject will receive prompt and definite consideration."

This was an undertaking which the members of the Society felt as too great a burden for any of them to assume. Moreover, the many legal questions involved called for a great deal of the very best legal advice obtainable. There has been a feeling in Washington that when engineers, in private practice, or connected with mining interests, proposed changes or alterations, that it it was done at the initiative of some private interest, that some one had an ax to grind. Suggestions have not received the serious consideration that was warranted by the sincere efforts and honest work that have been spent upon them, and hence engineers were loath to devote further time to the subject unless sponsored by some individual or organization which was above any possible suspicion of an ulterior motive.

At this stage the President of the Society, Mr. Ingalls, and the Director of the Bureau of Mines, Mr. Manning, held several conferences, the outcome of which was that the Bureau of Mines undertook to interest itself in the formulation of a revised code, to appoint an advisory committee which would be nominated by the Council of the Mining and Metallurgical Society, and furnish the legal talent necessary from its own staff.

Mr. W. R. Ingalls was appointed Chairman of this Committee, and Mr. Walter Douglas, Vice-Chairman. Mr. H. V. Winchell was asked to serve, but owing to the fact that he was just at that time leaving for the Far East, declined the appointment. The other members were: Messrs. Channing, Finlay, Hammond, Ricketts and Hennen Jennings. Mr. J. R. Jones, law examiner for the Bureau of Mines, was nominated secretary and legal adviser to the committee. Since the death of Mr. Jennings, Mr. Winchell has accepted appointment and is now a member of the committee.

During the War, neither the attorney nor the members of the committee were able to give this subject any consideration, but since the armistice Mr. Jones has carefully examined the discussions of the Society, the results of the referendum, and the questionnaires that were sent out, and has prepared a tentative draft of a code from which has been eliminated those parts of the old code that appeared to be antiquated, or of no further value. The result is a draft which harmonizes the majority views as expressed during the past few years with such parts of the existing code as appear most desirable to retain. Due consideration has also been given to the practical and impractical in making alterations.

Recently Mr. Jones has resigned his position as secretary, and Mr. Paul S. Black, of the Bureau, has been appointed in his place.

The draft has now been submitted by the Bureau of Mines to the members of its committee who are giving it their consideration. At the same time a copy of the draft was placed in the hands of the Chairman of the Committee on Mines and Mining in both houses of Congress. It is hoped that by making these chairmen virtually a part of the committee, that the draft will ultimately assume the form of a bill which can receive the undivided support of the two Congressional Committees without much discussion. Of course, it is not proposed by the Bureau of Mines to try to have this bill passed without adequate and complete discussion, but rather to bring it into such form that little discussion will be necessary and few objections offered.

Wide circulation will be given the draft or the bill, and ample time will be given for full discussion before it is attempted to have it passed.

Joseph A. Holmes Safety Association.—The annual report of this Association just received gives the names of those to whom awards have been given and mentions the acts for which the awards have been made for the years 1919 and 1920. It is a significant fact that many of the recipients of the medals have been widows who have received them in recognition of the last great sacrifice made by their husbands.

The granting of medals is not, however, the main work of the Association; these awards are but milestones marking the progress of the Association upon the path blazed by Dr. Holmes during his life. The safety of life and limb in the mine and smelter was one thought that was always in the mind of the first Director of the Bureau of Mines. Dr. Holmes may not have been the first to think of the conservation of life and health of workmen, but workmen and operators owe a lasting gratitude for the work that he inaugurated and so vigorously carried on until his death.

The Bureau of Mines, on behalf of the people and the Government, and nearly all of the larger mining organizations, have developed machinery and personnel for furthering safety practice and safety education. This is the important thing and it was for the further encouragement of this organized effort for safety, aid to the injured, and rescue work that this association was formed. In this field lies its future efforts and usefulness.

The Association has worked without funds, except those privately subscribed for the purpose of awarding medals, and these funds have generally come from those personally acquainted with Dr. Holmes and his work. Now that the results of his indefatigable energy are evident in the statistical reports of accidents, every mining organization is feeling the practical benefit of his humanitarian ideas. From this time forward no argument should be necessary in order to secure the support of every mine in the country for the association. Its work is worth doing, it has been well done and every mining company in the country should consider it a privilege to extend its support to the organization and the men who conduct its affairs, foremost of whom is its Secretary, Dr. David T. Day, Washington, D. C.

Foreign Mineral Resources.—Statements have recently appeared in the technical press to the effect that the Bureau of Foreign and Domestic Commerce, functioning under the Department of Commerce, has been unwilling to distribute to those most interested in the subject, the information which it has secured relative to foreign mineral resources.

This matter being of great interest to many members of the Society, the Secretary has communicated with Acting Director R. S. MacElwee of the Bureau, and now takes pleasure in advising members that the statement referred to gave an entirely erroneous idea of the attitude of the Bureau. Far from limiting the circulation of its information, it is the desire of the Bureau to get it before everyone who may have the least interest in the subject under consideration. If it has failed to do this in the past it is only through lack of proper mailing lists, a lack which it hopes to remedy as time goes on through the cooperation of such organizations as the Mining and Metallurgical Society.

A recent publication of the Bureau, Commercial Handbook of China,* in two volumes of over a thousand pages, contains considerable information respecting the mineral resources of that country. This information is largely derived from consular officers and naturally is frequently of such nature as not to be of great value to engineers. General information respecting China, its laws, customs, trades, commerce, etc., is given in considerable detail, so that the engineer interested in the Far East will find in this publication a mass of general information that will be of material value to him.

Special circular FE-130 upon the Chia Shan copper property in Western Manchuria by J. M. Clements is a report of quite another type. This report is valuable, not because the property is of any value, but because Mr. Clements has visited it and examined it from the viewpoint of an engineer. The property is one whose name is known far better than its production warrants, and Mr. Clements' report may save one or more Americans several thousands of dollars at some future date, thousands of dollars that in consequence of this report may be used to advantage upon a less well advertised but more meritorious property in China.

National Public Works Department.—Congress adjourned without enacting legislation establishing a Department of Public Works, or reorganizing an existing department with the same object in view. Many equally important or more important bills failed to pass and there is no reason to feel discouraged in respect to this practical and much needed economy at Washington. Progress has been made and the progress has been easy because the proposal has been logical and one of the most praiseworthy that has been taken up by Congress in years.

The Mining and Metallurgical Society has, by referendum, recorded its vote in favor of the principle, and the Council has done what lay within its power to make this vote effective. Whether the work that has been done is to count or not depends mainly upon the efforts of individual members who are interested in the subject. Those members who are interested and believe the legislation ought to be enacted, should make a personal appeal to their Congressmen and Senators during the present vacation. If it is desired to study the question still further before approaching Congressmen or Senators, the National Department of Public Works, McLachen Building, Washington, D. C., will furnish members with literature on the subject upon application.

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*Miscellaneous Series, No. 84, in two volumes. Price $1.00. Supt. of Documents, Washington, D. C.

It may be of further interest to those who voted upon the question to know of the sentiment in Washington respecting the subject—Mr. Smoot of Utah introduced a resolution (S. J. Res. 191) proposing the creation of a Joint Committee on Reorganization. This committee was to make a survey of the administrative services of the Government for the purpose of securing information as to the extent of duplication and overlapping of authority, what redistribution of activities should be made to secure proper correlation of activities and the largest possible degree of efficiency and economy in operation. The committee was subsequently to prepare a bill and make recommendations.

As showing the general attitude toward the subject in Washington it is significant that this passed the Senate. An attempt was made to pass the bill in House on June 3 under a suspension of the rules for which a two-thirds vote is required. The bill failed to receive such a vote and was recommitted to the House Committee on the Judiciary.

As stated previously the task of Public Works Department Association is not finished, but it is evident from action in reference to the Smoot Resolution that there is a decided sentiment in Washington for the overhauling and rearrangement of national business upon more economical lines and it is probable that the efforts of engineers in this direction will show valuable results during the next session of Congress.

Boston-Washington Super-Power Investigation.—Engineering Council reports that substantial progress has been made in this matter. The Sundry Civil Service Bill carried an item of $125,000 for the purpose. Professor L. P. Breckenridge of Yale University has been selected to head the Advisory Board which will work in close cooperation with the engineering staff of the North Atlantic Seaboard Survey.

This huge engineering project has within it the germs of the solution of the serious situation which has confronted the United States for some time past. With power created at its source, at coal mines or water falls, and this power fed into trunk lines with branches reaching all municipalities and manufacturing centers of the east, the power question will be solved, the transportation of millions of tons of coal will be unnecessary and the railway situation will be vastly improved. No engineering project of recent times contains possibilities of such wide benefit to the people of the United States as does this undertaking of using our available water and fuel as they should logically be used.

Mining and Metallurgical Society
of America

Vol. XIII, No. 5 August–September, 1920 Bul. 141

COUNCIL.

Meeting of August 4, 1920.

A meeting of the Council was held at the office of the Society on August 4. Those attending were Messrs. Ingalls, Lindgren, Penrose, Sharpless, Westervelt and Yeatman.

Mr. Bartholomew, chairman of the 1920 Medal Presentation Committee, was present by invitation.

The meeting was called to order by President Lindgren. The minutes of the previous meeting were approved as distributed.

The question was raised by Messrs. Lindgren and Yeatman as to whether it would be wise to present the gold medal of the Society during the year 1921 in view of the action that had been taken in respect to the award being made at less frequent intervals. A slight change has been made in the rules governing the award of the medal but it must be voted upon at a meeting of the Society before it becomes effective, hence, until such action is taken, the Council is governed by the rule requiring that the medal shall be awarded annually.

The following subjects were suggested by Councillors as suitable for the award for the year 1921:

For Distinguished Service in

Prevention of accidents in mines and metallurgical operations:
Improvement in working conditions in mines and metallurgical plants;
Technical literature;
Contributions to the literature of mining and metallurgy;
War activities (mining, metallurgical or geological);
Economic development of the porphyry coppers;
Economics of mining and metallurgy.

The prevention of accidents and the advancement of welfare work appeared to be the favorite subjects of a number of the Councillors, and after full discussion of all the suggestions, it was moved and carried that the medal for 1921 be awarded for Distinguished

Service in Increasing the Safety of Men in Mining and Metallurgical Operations.

The Society had been asked for an endorsement of the classification and compensation of engineers as proposed by Engineering Council. Upon vote it was decided that approval or disapproval of this schedule scarcely came within the province of the Council and that no action could be taken.

The work of the Joint Conference Committee and the plans of the Federated American Engineering Societies were discussed, but it was not deemed appropriate to take any action on this matter until all Councillors had been communicated with. The matter was held in abeyance until the October meeting of the Council.

The Council having been asked to interest itself in the matter of conserving the American radium supply for medical purposes as opposed to commercial purposes, this matter was discussed at some length.

Members of the Council were of the opinion that the extent of the known and possible supplies of radium within the United States was too large to warrant national control of the element, and upon vote declined to take any action on the subject.

The meeting adjourned.

F. F. SHARPLESS,
Secretary.

UNITED STATES CHAMBER OF COMMERCE.

Report of Committee on Economics.

The Chamber of Commerce of the United States, of which the Mining and Metallurgical Society is a member, recently submitted to its membership a referendum (No. 31) of twelve principles applicable to relations of employment. As nearly all of these principles have been discussed at the meetings of the Society, it was felt that the Committee on Economics was fully informed as to the opinion of members, and that a referendum to the individual members of the Society was not required.

In sending the vote of the Society to the National Chamber the Secretary explained that the vote was not the result of a membership ballot, but was prepared by the Committee on Economics.

While this referendum was prepared with the idea of securing an expression of opinion, chiefly from manufacturers, the principles have to do equally with mining and the production of metals, hence it is deemed wise to repeat them for the benefit of members, adding the results of the referendum.

1. Every person possesses the right to engage in any lawful business or occupation and to enter, individually or collectively, into any lawful contract of employment, either as employer or employee. These rights are subject to limitation only through a valid exercise of public authority.

In Favor 1675—Opposed 2.

2. The right of open-shop operation, that is, the right of employer and employee to enter into and determine the conditions of employment relations with each other, is an essential part of the individual right of contract possessed by each of the parties.

In Favor 1665—Opposed 4.

3. All men possess the equal right to associate voluntarily for the accomplishment of lawful purposes by lawful means. The association of men, whether of employers, employees or others, for collective action or dealing, confers no authority over, and must not deny any right of, those who do not desire to act or deal with them.

In Favor 1677—Opposed 4.

4. The public welfare, the protection of the individual, and sound employment relations require that associations or combinations of employers or employees, or both, must equally be subject to the authority of the State and legally responsible to others for their conduct and that of their agents.

In Favor 1671—Opposed 4.

5. To develop, with due regard for the health, safety and well-being of the individual, the required output of industry is the common social obligation of all engaged therein. The restriction of productive effort or of output by either employer or employee for the purpose of creating an artificial scarcity of the product or of labor is an injury to society.

In Favor 1675—Opposed 3.

6. The wage of labor must come out of the product of industry and must be earned and measured by its contribution thereto. In order that the worker, in his own and the general interest, may develop his full productive capacity, and may thereby earn at least a wage sufficient to sustain him upon a proper standard of living, it is the duty of management to cooperate with him to secure continuous employment suited to his abilities, to furnish incentive and opportunity for improvement, to provide proper safeguards for his health and safety and to encourage him in all practicable and reasonable ways to increase the value of his productive effort.

In Favor 1679—Opposed 2.

7. The number of hours in the work day or week in which the maximum output, consistent with the health and well-being of the individual, can be maintained in a given industry should be ascertained by careful study and never should be exceeded except in case of emergency, and one day of rest in seven, or its equivalent, should be provided. The reduction in working hours below such economic limit, in order to secure greater leisure for the individual, should be made only with full understanding and acceptance of the fact that it involves a commensurate loss in the earning power of the workers, a limitation and a shortage of the output of the industry and an increase in the cost of the product, with all the necessary effect of these things upon the interests of the community and the nation.

In Favor 1677—Opposed 3.

8. Adequate means satisfactory both to the employer and his employees, and voluntarily agreed to by them, should be provided for the discussion and adjustment of employment relations and the just and prompt settlement of all disputes that arise in the course of industrial operation.

In Favor 1668—Opposed 8.

9. When, in the establishment or adjustment of employment relations, the employer and his employees do not deal individually, but by mutual consent such dealing is conducted by either party through representatives, it is proper for the other party to ask that these representatives shall not be chosen or controlled by, or in such dealing in any degree represent, any outside group or interest in the questions at issue.

In Favor 1568—Opposed 54.

10. The greatest measure of reward and well-being for both employer and employee and the full social value of their service must be sought in the successful conduct and full development of the particular industrial establishment in which they are associated. Intelligent and practical cooperation based upon a mutual recognition of this community of interest constitutes the true basis of sound industrial relations.

In Favor 1664—Opposed 2.

11. The State is sovereign and cannot tolerate a divided allegiance on the part of its servants. While the right of government employees, national, state or municipal, to be heard and to secure consideration and just treatment must be amply safeguarded, the community welfare demands that no combination to prevent or impair the operation of government or of any government function shall be permitted.

In Favor 1663—Opposed 4.

12. In public-service activities the public interest and well-being must be the paramount and controlling consideration. The power of regulation and protection exercised by the State over the corporation should properly extend to the employees in so far as may be necessary to assure the adequate, continuous and unimpaired operation of public-utility service.

In Favor 1649—Opposed 18.

The Special Committee on Public Utilities of the U. S. Chamber of Commerce presented to the Board of Directors a report Concerning Regulation of Employment Relations to Public-Service Corporations. The propositions set forth in this referendum (No. 32) were submitted to referendum vote on June 9, 1920, and the balloting closed on July 24, 1920.

In this case also it was thought that the Committee on Economics was fully informed as to the majority opinion of the membership of the Society, and prepared its vote accordingly. The vote of the Committee was however cast as that of the Committee on Economics and not as a vote of the entire membership.

The propositions submitted, and the results of the balloting on each proposition, were as follows:

I. The Committee recommends that strikes by employees of all public-service corporations performing public service essential to the lives, health, security, comfort, and well-being of the people, should, by law, be explicitly prohibited.

1569 Votes in favor—100 Votes opposed.

II. The Committee recommends that suitable tribunals should be created by law to adjudicate differences between the employees of public-service corporations and their employers, and that the decisions of such tribunals should be final and binding upon both parties.

1578 Votes in favor—103 Votes opposed.

Wealth and Income.

The paper on "Wealth and Income of the People of the United States" that was read in abstract by W. R. Ingalls at the meeting of the New York Section of the Society on October 21, 1919, was published under the title of "Labor the Holder of the Nation's Wealth and Income" by the Annalist in its issues of September 13, 20 and 27, 1920.

COMMUNICATIONS.

Reciprocal International Laws.

The following communication has been received from Mr. H. Foster Bain, writing from China, under date of June 19:

To the Secretary:—

I fear that my ballot relating to reciprocal international laws respecting mineral rights will arrive too late to be counted as it has only just reached me.

I am heartily in sympathy with the underlying proposed law but fear that a set, mandatory statute would involve unnecessary and undesirable friction. The mere power to act would, I am confident, result in release of the main restrictions. Too drastic a law might seriously jeopardize important interests.

It happens that at present in Burma no "non-British" company or individual can hold a mining lease nor can any such own a majority of shares in any mining company owning a lease. In Burma all mining is on lease from the crown. This legislation was aimed at pre-war German activities, but now applies to all, including Americans. Its revision is already under consideration. In Transvaal on the other hand the spirit is not only friendly but the laws (unless very recently changed) are non-discriminatory.

Now to bring pressure on India, must we offend other parts of the British Empire and kick out, say, the Arizona Copper Company at home and various Canadian companies? Permissive rather than mandatory legislation is needed—something along the lines of the old reciprocity law as to tariffs.

(Signed) H. Foster Bain.

Foreign Mineral Resources.

Foochow, Fukien, China.
August 3, 1920.

Mr. F. F. Sharpless, *Secretary.*

Sometime ago I received Bulletin 135 of the M. & M. Society of America and note therein, p. 238, your communication to Dr. Smith of the U. S. Geological Survey and his reply.

You seem to be unaware of the fact that the Bureau of Foreign and Domestic Commerce has undertaken certain investigations along the line you suggest in your letter as being desirable for the Government to undertake, and I would call your attention briefly to what the Bureau has been doing. I wish particularly to emphasize the fact that the Bureau as early as 1917 appreciated that the prestige of the flag of a nation abroad is enhanced by its volume of foreign commerce, and with a view to increasing our foreign trade by encouraging mining investments in the Far East, undertook an investigation of the mineral resources of the Far East. This was done in spite of a shortage of funds and many calls upon the Bureau for expansion along other lines which might by many have been considered as more promising of immediate results.

This investigation was begun, at the instigation of Mr. Eliot G. Mears, Chief of the Division of Commercial Attaches, in 1917, while Dr. Pratt was the Chief of the Bureau. At this time there were appointed four Trade Commissioners to investigate various matters relating to foreign trade in the Far East. I was one of them, my field extending, as I was told, from Japan to Australia and Africa inclusive. No small field for one man without assistants, hampered by a small allottment and the usual governmental red tape in its expenditure. For instance the Bureau could not authorize me to buy even a compass or an aneroid barometer!

This investigation was undertaken with the distinct understanding between the officials of the Bureau and myself that the results of my studies were intended primarily for and would be made available to those interested in mining investments and to their advisers, the mining engineers and economic geologists. It was recognized that, with the limitations under which I was to work, my communications must be of the nature of reconnoissance reports of mineralized areas or short reports on individual mines or deposits; in other words, scout reports. The investors if interested should then send out their own engineers to make the necessary detailed studies.

My studies were begun in Japan, in order that I might acquire first hand knowledge of the basis of the metal industry of that country, but before my studies were completed I was called back on account of a shortage of funds. I returned to Washington in 1918 and prepared and submitted to the Bureau a lengthy report on "The Mineral Resources of Japan" and also gave, with the permission of the Bureau, the gist of my findings to the various interested committees in Washington then engaged in war work.

In 1918, at the request of Mr. B. S. Cutler, the new Chief of the Bureau and Mr. C. E. Herring, Chief of the Division of Foreign Investigations, I returned to the Far East to continue my work with the same understanding with the new officials as to the use to be made of the information I might send in as had been reached with the former officials. Shortly after I left Washington the then Chief of the Bureau resigned and since then two different Directors—as the head of the Bureau is now called, have held office, but the investigation has been continued.

Since my return to the Far East I have sent in a number of short reports dealing with certain metals and with non-metallic raw materials, chiefly of interest to exporters and importers. I have forwarded longer reports, designed especially for investors in mining properties and for mining engineers, on "The Shui Kou Shan Mine"—an important Chinese lead-silver-zinc property—and "The Tungsten Resources of Korea."

The short trade reports have been rewritten, multigraphed and distributed, to whom I do not know. What may have been done with the others I have not learned, except that a short negative report on a copper prospect has been multigraphed and distributed. This I did not intend for distribution. Indeed I do not know whether my report on "The Mineral Resources of Japan" has been published or not.

From the above you will learn that the Bureau has been carrying on such an investigation as your letter mentioned, such an investigation as I understand the U. S. Geological Survey, under its organic law, is precluded from undertaking directly. The Bureau has acquired some minor information of the mineral resources of Japan, Korea and China. If any of the reports sent in, or those which may be sent in in the future, are desired, no doubt lists of the subjects and copies of the reports themselves can be obtained from the Bureau.

The difficulties attendant upon getting information in China must be reckoned with if one is planning to come out here. There are about as many dialects in China as there are kinds of Heinz's pickles, and they are so distinct that a man in one district may not understand the spoken language of men in the surrounding districts, although the written language is the same all over China. For different districts one may require different interpreters, and a competent interpreter is hard to find and the finding of one usually means much delay.

It is almost impossible to get accurate information from the ordinary Chinese, because they do not have it. Information is sometimes freely given, but I have found that very commonly the more freely you are told things the less reliable are the things told you. When they know they may not tell you, unless they see a profit in the telling. In a certain asbestos producing district one old man told me he had the best vein in the district and dug out what he wanted and then covered up his work. No persuasive argument, including the offer of a reasonable sum of money, would induce him to show it to me.

One must also reckon with the general ignorance of the nature and value of ores, unless the men have before sold the ores, and the limited character of the development work done. Recently a man offered me a picul (133.3 lbs.) of specular hematite for $6.00 gold. He had no idea of the character of the ore but the weight and glisten appealed to him and he evidently thought six dollars a good price to begin asking.

Specific knowledge is commonly lacking where one would least expect ignorance, even of the location of deposits. The manager of the local office of one firm which does a good deal of buying and exporting of ore told me that his ore came from a deposit three miles due north of the village. It took him a day to get a guide to take us to it and we then went one and a half miles due west.

On another occasion I crossed a river bridge to call on the head of the Provincial Mining Bureau whose office faced the end of the bridge. On the river bank, above the bridge and about 500 feet from the door of the office, I saw a pile of about 50 tons of manganese ore awaiting shipment. The head of the bureau told me he had never seen the ore. It took him two days to learn where the ore came from and another day to get a guide. We found the deposit in a hillside a mile and a half behind the building where his office was located. Owners themselves often do not know exactly where the deposits are and very frequently will not go to them for fear of bandits, but send a coolie guide.

The slowness and difficulties of travel, which must be done over a large part of China on foot, or in a sedan chair or small boat, are familiar to all who have read about China.

I do not mention these things to discourage any mining engineers from coming to China but merely that those who come may be forewarned. Indeed I would urge that more American engineers come. There are several here now and a number have come and gone in the past year. But there are more mining engineers of other nations out here as visitors and as more or less permanent residents, engaged by large firms, than there are American engineers, and the United States needs her engineers here if we are to do our proper share in helping China develop her mineral resources and in aiding in the development of the foreign trade of the United States in China. Moreover at the present time the Americans are the chosen people in the eyes of the Chinese. You are always cordially received if you come with a smile and a statement that you are an American. But the ignorant among them credit us with too much ability to help them. Traveling in the neutral zone between the Northern and Southern armies at the time of an armistice I stopped late one afternoon in a temple. My cot had been stretched in front of the God of War and I was having a smoke after dinner. I was waiting until the mosquitoes should drive me beneath my mosquito bar, when a delegation of five elders from a nearby village was announced. After the usual preliminaries it developed that they had heard there was an American in the temple and having been tired of war for sometime they came to beg me to make peace between the North and the South.

The Chinese owning mineral properties come to me frequently asking for help from the U. S. in developing them. But generally they have no reports on which to base their requests, and of course I can not examine every property. I have on a number of occasions been able to recommend American engineers in China to such men.

Even in my short stay I have seen many evidences of the awakening of China. I am convinced that there are opportunities for profitable mining here and at the same time helping China in general lines of business and specifically in developing her natural resources. The political conditions are such as to cause the timid investor to hesitate but foreign investments are as a matter of fact scrupulously protected by all Chinese.

I hope that in my reconnoissance of China I may learn of mineralized areas warranting close study and that through my reports I may help in some small part in attracting the attention of mining investors and mining engineers of the United States to the mining possibilities of China.

Sincerely yours,

J. Morgan Clements.

Pyritic Smelting.

August 25, 1920.

MR. F. F. SHARPLESS, *Secretary*.

In going over some old correspondence I happened upon a relatively recent letter from W. H. Freeland in which he replied to an inquiry that I made respecting the conception of his work in pyritic smelting, in which important subject of course the profession knows he was a practical pioneer. I think it would be worth while to put Mr. Freeland's statements, which were given to me under date of June 28, 1918, on record in the bulletin of the Mining and Metallurgical Society of America. Excerpts from Mr. Freeland's letter follow:

"The conception of pyritic smelting, as you know, originated from the famous Bessemer steel process as early as 1855, and had been the goal of all copper smelters ever since. The first 'touch-down' however, was not scored until 1880, when Pierre Manhes introduced his Bessemer converter for copper mattes. That gave the pyritic smelting theory a decided impetus and the copper smelter commenced to 'buck the line' in earnest. There were now many 'touch-downs,' but it remained for Mr. Robert C. Sticht to 'kick the first goal,' in the Tasmanian field.

"It was my good fortune to enter the field under Mr. Herbert Lang, at Keswick, California, in 1895; and perhaps my better fortune, to visit Mr. Walter Douglas shortly after his return from a visit to Mt. Lyell, Tasmania. From Mr. Douglas I got many details of Mr. Sticht's successful practice there, which were helpful to me in working out the Ducktown problem.

"Owing to smoke suits and threatened injunctions, an important feature of the Ducktown problem was the conversion of the sulphur, into sulphuric acid. With the abolition of open-air roasting and the consequent concentration of the sulphur fumes in the smelter stack, that conversion became a possibility. The Tennessee Copper Co. speedily adopted the Ducktown Sulphur, Copper & Iron Co.'s new smelting practice, enabling it to make acid. Today the combined acid product of these two companies is enormous."

Yours very truly,

W. R. INGALLS.

Recreation.

To the Secretary and Members:

Edward Bok in the *Atlantic Monthly* of September presents some suggestions respecting the life and activities of busy men which should be taken under serious consideration by mining engineers.

As a type we are busy men. When we have one or more problems on our hands we are so deeply absorbed that we have no time for mental relaxation, or we think we have no time for it. We play a game of golf or go to the theatre and think that we have taken all of the mental relaxation that is required. When no mining or metallurgical problems are confronting us, we are under an equal or a greater mental strain searching for a problem that will give us an opportunity to use our technical knowledge; the time for play slips by and we are at work again. Work thus becomes a habit; we do not know how to play, and we die with our boots on.

If the question were asked in the form of a referendum,—"do you wish to die with your boots on?"—it is probable that 99 per cent of our members would answer "Yes." But would it not be better for us and for the next generation if we died with our shoes on while the younger men were wearing the boots?

Technical journals and society bulletins have published page upon page exhorting engineers to get into civic and political life and take that part for which their training so well fits them. Many of us who read these effusions think that we are in hearty accord with them and hope that some brother engineer may be influenced to curtail his technical work and get into local politics, since you and I have no time for that sort of stuff.

Circumstances may force some of us to die in the harness, may force many of us to chase dollars from our college to the grave, but is this not a condition more frequently imagined than it is real? Is it not because we are unwilling to set a mark or aim at a mark below that of the affluence of the most successful engineers—a mark that is beyond the reach of the great majority?

In America life of the professional man is generally divided into two periods. First, that during which he is acquiring his education; second, that during which he is practicing it. From the latter he steps into his grave. In England, and upon the continent of Europe, people have learned that there is a third period in life—that during which one is permitted to enjoy the fruits of the second period. The third period is one during which the professional man may relax and do as he pleases or do what he wants to do. This is not necessarily an idle, useless period, but rather one of an altruistic activity, one during which the professional man may work along those lines from which he gets full enjoyment, from which his fellow man secures benefit, and which leaves the world better off when he has passed on.

Few Americans have the ability to acquire a competency through close application and then step out suddenly as through a screen, and engage happily in an entirely new line of thought and occupation. If we attempt it many of us find ourselves without resources, a burden to ourselves and a nuisance to our families. We have not properly prepared for the third period of life, we are not competent to enjoy the rest and recreation that we have earned, and because we know that this will be the case we hang on to our working boots when the soles are gone. We imagine that we are still essential members of the profession, and that our associate, ten years younger, is an amateur by comparison. When the soles of the boots have worn thin, the sharp stones of adversity cut our feet and irritate us. The frosts of disappointment are felt keenly when our digging clothes are badly worn and our blood is circulating slowly. When we are past the prime and must wear glasses we can not see those big opportunities of the future which appealed to us when our sight was keen and imagination not bruised by hard knocks of experience. We stand in the way of younger men better fitted to contend with the new problems of the day. Our years of experience are valuable, but should be used to assist not to hinder those who are to follow in our foot-steps.

But what has all this to do with the members of the Mining and Metallurgical Society, men engaged in the active practice of their profession?

It is simply an appeal, in another form, that they should take a more active interest in the affairs of today; that they mix in a little play with their work; that they take some real mental recreation along with their golf or tennis, that they prepare for a third period of life into which they may step without shock to the nervous system.

Members, you all (as they say in the South) have ideas, thoughts or dreams outside of your strictly professional work. Make them, do them, or get them on paper, get them out of your systems, let the rest of us have the benefit of them.

There will be no money in it for you or for me, but all members will benefit and with us humanity; incidentally you will be taking a little recreation that will prepare you for further enjoyment along the same lines.

Pretty soon you and I will be receiving notices from our Secretary telling us that our annual installments are due. "Plagued nuisance," we say; "what do I get out of it?" The notice lies on the desk for a while until, getting ashamed of seeing it there unpaid, we send the Secretary a check and think it's all over for a year. But glad as the Secretary and Council are to see the check and learn of the sustained interest in the Society, to that extent, I know, because I know these men, that they would ten times rather have a letter asking why they were not busy on some subject dear to your heart, a subject on which you are real warm, or mad all through about. I am sure that I voice the desire of many members of the

Council when I beg for a little of your time, just enough to tell us something of what you are thinking, for just a little recreation on your part.

A MEMBER OF THE COUNCIL.

Alaska Coal Lands.

Sept. 9, 1920.

MR. F. F. SHARPLESS, *Secretary*.

A client, who is very much interested in the financing and development of the Bering River coal field, recently consulted with me in regard to this subject and on my suggestion we went to Washington to talk the matter over with Mr. George S. Rice, Mining Engineer for the Bureau of Mines, and Mr. Clay Tallman, Commissioner, General Land Office. We discussed freely with these men the general plan of financing and soon learned that the regulations with reference to operating coal lands in Alaska are so drastic that it will be most difficult to interest capital.

Since the Mining and Metallurgical Society has taken such an active part in the past in recommending a general revision of the mining laws, I suggest that the Society devote one or more evenings to the discussion of the coal mining regulations in Alaska, as outlined in Circular No. 491, Department of the Interior, "Title to Public Lands in the Territory of Alaska." The coal regulations in particular are discussed on page 61 and those immediately following.

It is a subject which the Society as a whole should be interested in and it might be advisable to petition Congress to revise to some slight extent the present regulations.

So far as I have been able to learn the coal varies in the different areas from bituminous to anthracite, and from coking to non-coking. A railroad has been partially built from this field under consideration, and capital will be required to complete the railroad to deep water and construct terminal facilities.

Following are a few of the points which tend to keep capital from investing and in my opinion should be revised in such form as to be inviting to capital.

Section 3 states:—"That no railroad or common carrier shall be permitted to take or acquire thru lease or permit under this act any coal or coal lands in excess of such area or quantity as may be required and used solely for its own use"—which is equivalent to stating that no coal mining company may own and operate a public railway.

This section prohibits a public carrier from mining and selling coal. Such a railroad will be dependent upon the successful operation of a coal mine by a separate company, otherwise it will have no freight. In case such coal mine is under financed the railroad company, as I interpret the laws, would be in no legal position to assist the coal company and make its operation successful.

The object of the present regulations is to prevent an individual company from obtaining a monopoly but I consider the regulations have gone too far for the welfare of Alaska, and I am of the opinion that a railroad company or public carrier should be permitted to own and operate its own coal mine for the public sale of such coal.

Section 4 states that the maximum amount of land which can be leased is 2560 acres to which I see no objection but the section further states that such lands must be contiguous, which is objectionable. Since the character of the coal varies greatly it will probably be to the interest of a coal company to scatter its leases so as to obtain coal of different qualities. The Government has divided the coal lands into leasing blocks of 40 acres or multiples thereof, "and in such form as, in the opinion of the Secretary, will permit the most economical mining of coal in such blocks" (Section 3).

I interpret the above to mean that all leasing blocks are accessible so far as possible. Scattering the total of 2560 acres, instead of making it contiguous as required at present, would, of course, render it impossible to operate from one central plant, but would in no way work to the disadvantage of another coal company.

I can find no regulations prohibiting a coal company from owning a tram road of standard gauge, but under such conditions the mining company could carry no passengers, mail or public freight. Under these conditions all general supplies would be hauled for the benefit of the coal company and controlled by such company, which is not the intent in Section 12, stating that provision must be made to secure to the workers complete freedom of purchase.

Considerable money has been expended and large sums will be required before the Alaska coal deposits are operated on a profitable basis. The laws should be revised so as to interest large capital in developing these resources.

Very truly yours,

Louis D. Huntoon.

A Foreign Policy.

Every American mining engineer who accepts engagements abroad sooner or later becomes cognizant of the fact that he conducts his work under greater difficulties than do his English, French or German confreres. It has not infrequently been the case that an American engineer has secured assistance from a European consul when such assistance has been denied by the representative of his own country.

This is by no means always the case but it has occurred so frequently as to cause us to marvel at the foreign policy or lack of foreign policy of the United States, and it has raised the hope that at some future date and under some administration we may be able to go abroad knowing that, while conforming to the laws of the land in which we work, we will receive every possible assistance from that country which we call home and to the treasury of which we pay our taxes. It is not the paying of taxes which hurts the most but rather that feeling of being out of touch with home, the lack of any sympathetic bond between Washington and ourselves. And speaking of taxes, Mr. George A. Laird writes to the Secretary as follows:

New York, Sept. 30, 1920.

To the Secretary:

I quote the following from the New York *Times* of August 15, as it is in line with the thoughts of many Americans who have to do with foreign countries:

Tax on Incomes Earned Abroad.

To the Editor of The New York Times:

"Taxation Without Representation" (so I have been told) is what caused all the unpleasantness back in '76, and I would certainly like to see the constitutionality of the income tax as applied to the American citizen who is making his living in foreign parts tested out. Friends of mine who have returned to the States after an absence of years have been forced to pay taxes on several previous years, with fines, and have been denied passports to return to South America for lack of income tax receipts.

Inasmuch as we get absolutely no protection from the United States Embassies in any of these countries, and are living solely upon the resources of foreign countries, I am rather curious, as a matter of academic interest, to find out if the United States Government really has a constitutional right to collect from us. We, the Americans here, feel that if such is the case our United States citizenship is nothing more than a dead loss to us, and the sooner we become citizens of Britain, Germany, China or Africa the better it will be for us. For confirmation of these sentiments, ask any returning resident from any South American country (or Mexico).

H. E. MERRYMAN.

La Paz, Bolivia, July 8, 1920.

It has occurred to me that the Society might take up the matter of getting something for the money paid by those who work abroad in income taxes or releasing us from the payment of those taxes until such a time as our State Department awakens to the fact that, as Mr. Merryman states: "Citizenship is nothing more than a dead loss to us and the sooner we become citizens of Britain, Germany, China or Africa, the better it will be for us."

This statement is somewhat strong, but it is just what many Americans think.

I have noted in one of the recent dailies that one of the nominees for the Presidency has stated that in case of his election, there will be a change in our "foreign policy."

What is that? Have we one?

Geo. A. Laird.

Mining and Metallurgical Society
of America

Vol. XIII, No. 6   October-November, 1920   Bull. 142

COUNCIL.

Meeting of Nov. 10, 1920.

A meeting of the Council was held at the office of the Society on Nov. 10. The meeting was attended by the President, Prof. Lindgren; Messrs. Arnold, Ingalls, Knox, Penrose, Westervelt; and the Secretary, Mr. Sharpless.

The ballot for officers and councillors for the year 1921 was prepared and ordered to be issued by the Secretary on Nov. 11.

An invitation to join the Federated American Engineering Societies was read by the Secretary, and a long discussion followed as to the advisability of the Society's doing this. Nearly all councillors were heard from, either by letter or in person, and there was considerable divergence of opinion as to whether the influence of the Society could be exerted to the best advantage as a member of the Federation, or if entirely independent thereof.

There was no difference of opinion as to the advisability and necessity of doing the work that is being done by the Federation. The only point was how this Society could do its share of this work to the best advantage.

Because of the divergence of opinion in the Council, and because of the expense incident to membership in the Federation, it was voted to place the matter before the entire membership in the form of a referendum, this referendum to state as fully as may be the objects of the Federation, and to be accompanied by letters from those who favor, and those who are opposed to the Mining and Metallurgical Society's joining. At the same time a statement as to the financial condition of the Society and its needs for the coming year was directed to be made, with the request that members vote upon the amount of dues which shall be paid for 1921.

An invitation for a preliminary conference with mine labor leaders was read and a committee was appointed to arrange such a meeting. It is hoped that one or more conferences may be held between some of the mine labor leaders and the members of the Mining and Metallurgical Society for the purpose of an exchange of ideas, and that there will be some co-operation which will be mutually beneficial.

A committee consisting of Messrs. Gottsberger and Berry was appointed to attend a meeting on Nov. 11 for the purpose of considering the standardization of certain mining equipment. This meeting will also be attended by representatives of the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, the National Safety Council, and the U. S. Bureau of Mines.

The Secretary announced that Mr. Richard A. Parker and Mr. George E. Collins had been appointed to act as representatives of the Society at the meeting of the American Mining Congress in Denver on Nov. 15-19.

Mr. Mark L. Requa and Dr. Ralph Arnold were appointed delegates from this Society to attend the meeting of the American Petroleum Institute in Washington, on Nov. 17, 18 and 19.

The Secretary reported that the committees on Post-Graduate Education and Vocational Training would soon have their formal reports ready to submit to the Society.

F. F. SHARPLESS, *Secretary.*

MEETINGS OF SECTIONS.

NEW YORK SECTION.

Meeting of Oct. 27, 1920.

A meeting of the New York Section of the Mining and Metallurgical Society was held at the Columbia University Club on Wednesday evening, Oct. 27. After the customary dinner, a short business meeting was held and the following officers were elected for the ensuing year: Chairman, J. A. Church, Jr.; vice-chairman, Wilber Judson; secretary-treasurer, Louis D. Huntoon.

Mr. Church, the chairman, announced that the subject of the evening would be "Petroleum," which he characterized as a very broad subject and a rather vague one. He introduced Dr. Van. H. Manning, who, he said, would "speak for and urge the formation of one of those economic projects of action which we have so far tried to replace with political co-operation with results known by all."

Dr. Manning.[*]—As I look around at this table, I recognize a great many faces of those who co-operated so generously with me during the war and enabled me to accomplish many difficult undertakings; and I cannot overlook the opportunity of expressing to each one of you my thanks for your assistance in the splendid co-operation that you offered to the Government.

A few days ago I went back to Oklahoma after having visited that country twenty-five years ago, you might say, as a pioneer. At that time I was not looking for oil in particular but was making the surveys that were essential to the development of the big industry that followed. After twenty-five years—a quarter of a century—I went back for the first time as a prophet to show the oil men of that locality that I had come as one of the wise men of the East. I told them that they must go to the East and seek for oil to furnish light and power for the world. Tonight in my discussion of this subject you must bear in mind that my eyes are directed toward the Eastern Hemisphere. I selected the subject of my remarks this evening after some consideration and because I have been talking on the international aspect of the petroleum problem on previous occasions. I recently spent two months in Europe and the whole time I was there I was trying to develop a spirit of friendliness and co-operation with France and Great Britain. My subject is "An Oil Entente," which will be described as I read it to you.

One of the unfortunate results of the war has been a departure from a friendly spirit of competition in business among some of the nations of the world. There has developed a nationalistic tendency, involving programs of exclusion or discrimination against aliens, and the policy of one-power and monopolistic development of domains by the nations under whose sphere of influence the territory happens to be.

We must expect as a natural result of the war an awakened sense of self-protection. All nations may well give serious consideration to the question of their future supply of raw products, but this must not be at the price of sacrificing principles in international trade which are the very substance of world progress in peace. The rules of competition should not be discrimination; a policy of discrimination is distinctly irreconcilable with the broad motive of national security, as we see it in this country. It is, moreover, not a far-sighted policy to conserve within the confines of any nation the materials which are now essential to civilization and the world's progressive welfare.

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Domination of Petroleum Sources.

There are twenty-one countries or national groups now classified as producers of petroleum. Several of these produce in a small quantity, have marketed little oil, and are, more properly speaking, producers in a potential sense. The countries whose outputs total over 35,000 bbl. annually, number seventeen. The nationality of the dominating interests in the present producing countries is divided. In the United States, Mexico, Peru, Canada, and Colombia (the latter country not yet marketing any oil), Americans are the largest producers. India and Persia are under exclusive British control. In Russia, Dutch East Indies, Roumania, Trinidad, Egypt, and Venezuela, the British-Dutch hold the dominating interests. The French are the major producers in Galicia, Alsace, and Italy; they dominate in Algeria where the English are also interested. The Argentinians control and are the major producers in Argentina; the Germans are the major producers in Germany; the Japanese, in Japan and Formosa; and the Portuguese and Americans in Angola, which is still a potential rather than an actual producer.

It has been stated that America is in no position to talk of foreign domination of the oil resources of the world when American interests control something like 80 per cent of the world's present actual production. But of the world's present petroleum output, 69 per cent is being supplied from wells within the territorial limits of the United States—a home production in our back yards, and often in our front yards, the development of which, however, has been as open to participation by foreign interests as by American citizens.

The Crisis in Consumption.

It is generally admitted that we of the United States are confronting a great crisis in the oil industry, and it is therefore pertinent to the discussion of this great international subject to make an analysis of our own supplies and demands, since we are the largest producers and consumers of petroleum and its products. We are consuming more of these products than we are producing within our own territory. The latest statistics show that this year's domestic production will be about 450,000,000 bbl. of oil, and our imports from Mexico this year will probably be 125,000,000 bbl., a total of 575,000,000 bbl.

The rapid development of the automobile industry gives a visualization of a condition of gasoline consumption that must be reckoned with for the future. The growth of farm tractors and airplanes is creating a great market to be supplied. Industrial and marine uses of fuel oil are taxing the oil industry to the utmost. One gets a very graphic picture of the probable ascent of the consumption curve and of the gravity of the production situation when it is considered that this nation is predominant in the use of the internal combustion engine—that we operate approximately six-sevenths of the motor-driven vehicles of the world. Compare the production of 1919, 377,000,000 bbl., and imports, 52,000,000 bbl., with the 1920 figure of 575,000,000 bbl. Be it said to the credit of the oil industry that it met this unprecedented demand for petroleum.

United States and Future Supplies.

I have been referring heretofore to production figures only. Now we turn to the future supply and by this I mean resources in the ground. It is estimated that the United States has about 12 per cent of the recoverable oil in the ground and Mexico has about 7.5 per cent. In the United States and Mexico, American citizens control by ownership about 16 per cent of the world's future supply of oil. Outside of the United States, American capital controls about 2 per cent of the oil resources. This means that the United States controls only 18 per cent of nature's oil-storage tanks. Do these figures suggest to you a monopoly by the United States? On the contrary, they emphasize the necessity for an immediate declaration on the part of our Government of a petroleum policy which should be prompt and definite—a policy that will encourage Americans to develop foreign fields. The United States has never taken advantage of its political influence or its control in the affairs of its people to close the door to outside interests. Nor has the United States taken the attitude that it did not approve of concessions being given to other nationals because it believed the concessions should be conserved for our own use.

There are seventeen countries, inclusive of colonial possessions, which have laws or regulations directly, or indirectly, or remotely relating to restrictions on petroleum development. Some of these restrictions which discourage American development of foreign fields are as follows:

1. Foreigners and foreign nationals are debarred from owning or operating oil-producing properties.
2. Government participation in ownership and control of petroleum companies.
3. Restrictions of nationals to sell their properties to foreigners.
4. Prohibition of the transfer of shares in companies to other than their nationals.

5. Complete nationalization of the mineral resources of which petroleum is one.
6. Special government license.
7. Denouncement of mining properties which were acquired in accordance with existing laws.

The restrictive measures which have gained headway in many outside territories supply an answer and furnish an exhibit strikingly illuminative of the necessity of our Government's having a definite petroleum policy.

I wish to state directly that in the absence of any such policy our Government, through the State Department, has taken many steps looking to the removal of restrictions which operate directly or indirectly against our citizens in foreign countries. Representations have been made to every oil-producing nation in which Americans are operating where restrictive laws or regulations obtain. But of what avail are representations unless they are backed by the forceful definiteness of a real policy? How can American interests be best supported, taking into full consideration the various aspects of the international petroleum situation?

Suggestions as to Policy.

Suggestions of constitutional amendment to admit the levying of an export tax have been made. Others include the placing of export embargoes, the re-enactment of that clause of the Tariff Act of 1919 which is a retaliative measure, and the Federal chartering of an oil corporation to engage in foreign operations. All of these suggestions require Congressional action. A rather unique suggestion was made that the President of the United States should say to the oil men, "Go out into the world and drill for oil and the United States will protect you." Our diplomatic representatives have been at a hopeless disadvantage in many of their negotiations.

Of course, it is to be understood that I am not authorized to act as a spokesman for the Government of the United States in its negotiations with foreign countries, but, due to my former official status with the United States Government and a subsequent knowledge of oil matters, I do find myself in a position to say that your Government is serving you to the best of its ability and is not only fully aware of the gravity of the problems, but has for some months been taking a vigorous action toward its solution. The British government has been conducting correspondence with the United States Government on the general oil subject. The American point of view in respect to the principles upon which provisions are to be agreed upon for the distribution of oil produced in mandated countries, is that a mandatory is not privileged to exploit raw materials produced in mandated territory for its own benefit and that all nations should enjoy equal commercial opportunities in such territories. It is significant to know that the open-door principle is one which both American political parties have always strongly championed.

In the latter part of June, I attended the meetings of the International Chamber of Commerce held in Paris, as a delegate from the American Petroleum Institute. The American delegation representing petroleum presented the following recommendations which were made a part of the resolution adopted to encourage production of petroleum products:

> The American delegation representing petroleum advises:
>
> That the consumption of petroleum throughout the world is exceeding production;
>
> That the consumption is constantly increasing;
>
> That the world is confronted with a serious shortage in the near future unless energetic efforts are made to increase the production;
>
> That in their judgment sufficient undiscovered petroleum deposits exist in many parts of the world to supply present and future requirements;
>
> That curtailment of exploration and production is being caused by restrictive laws and regulations of many governments;
>
> That a free opportunity to all nationals to explore and develop the petroleum resources of the world wherever found should be freely extended.
>
> They therefore recommend that laws, regulations, or administrative acts which tend to retard the development of the petroleum resources of the world should be repealed or revoked, and that equal privileges in all parts of the world be granted to nationals of all countries in the production of this great and useful national resource, so vitally essential to the world's progress.

The representatives of the five great nations, the United States, Great Britain, France, Italy and Belgium, realized the dangers of conflict in discriminations to the countries which own raw materials, and a committee is to be appointed to "study the status of raw materials during the period of economic balance, which status shall be based upon the principle of economic fairness for all countries."

Importance of Statistics.

A fundamental basis for an economic study of any industry is complete and reliable information not only for the determination of a sound international, political, and commercial policy, but also for the intelligent conduct of commercial enterprise; therefore the board of directors of the International Chamber of Commerce were directed "to consider the advisability of establishing a central bureau of international statistics for the purpose of collecting, centralizing, analyzing, and interpreting statistical information for the business interests of the world," and it was urged upon those agencies charged with the collection of statistics that they "take immediate steps to secure a greater degree of international uniformity in the classification of statistics and the method of determining the value and quantity units used in recording them." The American Petroleum Institute has announced its purpose to collect, analyze, and interpret all the world's petroleum products statistics, and the co-operation of all the oil interests is necessary to bring this important work about.

Great Britain and the United States Minus a Policy.

If governments undertake to venture in the oil business it destroys the formation of international competition. Great Britain became interested as a partner in the oil business; therefore, she has become the target of international criticism, not, however, on the ground of a business enterprise, but on the charge that she was developing an oil policy which definitely excluded foreigners from participating in the development of the areas over which Great Britain exercised control. It is stated by British officials that Great Britain has no definite petroleum policy, nor have we a policy. If these two great nations admit, which they do, that a foreign policy is essential, the United States should be the pioneer in legislation and the motto of "strict impartiality, fairness and protection" should be fastened at the mastheads of the "Ships of Nations."

United States Oil Interests Abroad.

What now is the position of the United States in petroleum areas of the world, these empires so extensive and vast in their present scope and potentialities that no one corporation or nation can expect to gain or maintain control of them? While we are still pre-eminent in production, refining and transportation, are we secure—is the world secure—in the fundamental matter of continued adequate supply of the raw material?

My opinion is that the Navy and the merchant marine should have a preferential call on oil for their bunkers because of its many advantages over coal. These practical advantages were demonstrated during the war with the result that other nations of the world were convinced of the desirability of oil fuel. The natural and inevitable result has been a wild scramble on the part of the great nations to secure sources of petroleum supply. The former self-sufficiency of the United States because of its relatively large production, has made our nationals rather backward in acquiring concessions and leaseholds in foreign fields, particularly where they were not contiguous to our own borders. Some few United States oil companies have gone abroad extensively but they have had to contend with many difficulties in obtaining concessions in the promising potential production areas of the world. In dealing with a commodity as varied in production as petroleum, estimates of future reserves are subject to a large coefficient of error, but the best scientific estimate indicates that there is an evenly balanced distribution of petroleum between the Eastern and Western Hemispheres. The petroleum resources of the world are today hard put to supply the vastly increased demands for petroleum products of all kinds, and the welfare and security of any nation so far as its petroleum products requirements are concerned, must be predicated upon the maintenance of reciprocal relations between nations and a strict adherence to the principle of reciprocity.

It is only by the free and unhampered development of the petroleum resources of the world that they can be obtained and maintained for the future in sufficient quantities to meet the universal and ever-growing demands of all nations. The world today is confronted with a petroleum problem which demands serious consideration by all nations working as a unit under a plan capable of immediate application, and the future peace of the world depends to a very great degree upon a unity of action which will assure equal treatment to all nations in their exploration and development of oil properties wherever found.

We are facing a situation that must be largely solved by the American oil men who have been the pioneers in the oil business, and it is not through any sense of proprietorship that they ask an entry into foreign lands to develop the oil resources of nations where capital and talent are unavailable or restricted. On the contrary, American oil men are influenced by a desire to render a distinct benefit to the world by seeking to perpetuate an industry which is one of humanity's greatest assets. .It is an inherent pride in the heart of every man who has contributed to the progress of science and industry to prolong the life of his creation. I am optimistic in my belief as regards the future development of the oil industry of the world, which belief is predicated upon my faith in the well-known ability and resourcefulness of the oil men of the United States who have done their share of the world's work. Their continuing efforts will depend largely upon the support they receive from their Government. A rule of action enunciated by Thomas Jefferson was a principle "that the American citizen abroad owes and discharges tax and military service to the United States. The United States owes and must discharge to that citizen the duty of protecting him in his life and property." This is good Americanism. It does not mean war or commercial destruction. It means peace and prosperity among nations. Venturesome oil men will be loath to risk their investments in the development of properties when changes in government, retroactive legislation, or empirical regulation, work to the spoliation of their acquisitions. Our Government should continue to insist on the open-door policy in all countries, and when this policy is conceded, effective means should be provided to protect such rights acquired by American citizens.

I wish it were possible for me to announce to you concretely what is to be the policy of the two great countries that I have just visited—England and France. They say they have none, and like them we must also plead guilty. Our Chief Executive, members of the Cabinet, Ambassadors, Senators, Congressmen, and oil men agree as to this phase of the international situation, but who is to take the initiative in framing a policy? Congress says we must wait for the Administration or the oil men to tell us what is required. My advice to the oil industry is to agree upon a fundamental principle and urge its adoption. The last official word on this subject was issued by the Federal Trade Commission in its report to Congress on June 1, 1920, on the causes of the recent advances in the price of petroleum products. It said:

> While the production of crude oil in this country is still on the increase and the present sources of supply appear to be adequate for some time to come, the probable gradual decline of crude oil production in the country in the not remote future, according to the general prediction of geologists and the men engaged in the industry, makes it seem the part of prudence to encourage those engaged in such industry in this country to develop production in such foreign countries, which have oil resources as are most available for furnishing supplies of oil; and that such enterprises should be given all proper diplomatic support in obtaining and operating oil-producing property.

Suggested Plan of Action.

Again, I say, our diplomats are doing all that is humanly possible to untangle this intricate problem and your help is needed. No greater or more lasting and far-reaching service can be rendered to the world at the present time than making possible and effecting the securing by or for American citizens of a participation in the development of the world's resources of petroleum. This may be accomplished under the following plan:

1. To make a careful study of the oil resources of the world and the laws and regulations governing these resources.
2. Congress should enact a general reciprocity measure covering all trade relations with foreign countries.
3. To encourage our nationals to acquire and develop and market oil in foreign countries:
    (a) By an assured adequate protection of our citizens engaged in securing and developing foreign oil fields.
    (b) By co-operative action on the part of the industry under Federal charter or otherwise that will permit the industry more effectively to perform its function in seeking out and acquiring oil territory in foreign countries, developing the same and distributing the petroleum produced therefrom.

When these things have been accomplished, our State Department should begin its negotiations to develop an oil entente for all nations. We cannot indefinitely carry the burden of furnishing the potential supply of petroleum for the world, and if there could be brought about an association of international relationship among these oil-producing countries working in harmony to furnish the world with power and light, a repetition of a world war would be impossible.

Mr. Church.—Dr. Manning has not only outlined a fascinating side of the subject, but he has issued a call to the profession, and especially to this New York Section, for concrete discussion and potential action.

Can we not hear from oil men, or men interested in oil, or men interested in those broad questions of relationships of nations from an economic rather than a political basis, or men interested in the broad problems of world economics as they work themselves out according to natural law and not according to international agreement?

Mr. Ingalls.—This is a subject to which I have not given much thought with especial reference to oil. It seems to me, however, that the oil men are probably right in their ideas that the demands for oil are going to increase to a greater extent than any increase in production that is in sight; that such excess of demand is likely to be reflected in higher prices for oil than we have seen prevailing in the past, or especially in pre-war times; and if conditions are expected to be such—and in all probability they will be—it is highly important to give broad international consideration to the subject on the lines that Dr. Manning has indicated and suggested. The civilized world is now just crossing the threshold of the economic readjustment that was inevitable following the war.

As I said in an address to this Society at the beginning of 1919, the world could not experience such terrific losses as it did during the war and have any reason to feel good about it, or any reason to feel that any basis of great prosperity had been laid. On the contrary, the prospects were precisely reversed. However, during 1919 very few people appreciated this and the people of both Europe and America entered upon a course of great extravagance, acting on the false theory that something had happened to make them richer than they ever had been before. The result has been that since about the middle of 1919 Europe has contracted an unfunded indebtedness to America to the extent of nearly four billion dollars. This indebtedness has been contracted to a very large extent for luxuries; and is mainly focused on London, which has been trying to finance the whole continent. London has bought goods in this country on open accounts which it has furnished to the continent on long-time payments. The London banks have now reached the limit of their resources, and the New York banks, which have been trying to help London, have experienced very severe strains. Our industrial and commercial companies have to a very large extent locked up their surplus and working capital in credits that they have given to Europe. At last the time was reached when the process had to stop. This marked the beginning of the delayed readjustment.

Europe henceforth must confine its buying of commodities from us to the things that it actually needs. It does not follow that it necessarily is going to buy. We all may need things very badly and not be able to have them because we have not the money with which to pay for them. This is primarily the reason for the sharp decline in commodity prices which began a few months ago, the process being hastened by the fact that the American spendthrift had also pretty nearly run his course. The readjustment is going to continue until many things, labor included, are at much lower prices. It is going to continue until the mass of the people both in this country and abroad appreciate that they must go to work for six days in the week and maybe ten hours a day instead of eight hours a day, in order to earn their living.

However, the process of readjustment is likely to be highly irregular. We have already seen irregularities in the course of events which indicate that such things may continue and may be even more marked. I can imagine, for example, that in the case of the production of a substance that the people must have, and whereof the production is made by an industry that is strongly unionized, it may be possible for the men engaged in that industry to exact terms that will cause the price for that commodity to remain very high for a long time after most other commodities have fallen pretty low.

Coal is very likely one example of such an industry and perhaps is the most important example. However, no matter how strongly such an industry may be unionized, no matter how brutally it may name terms which it can exact for that reason or for others, it cannot defy the laws of nature forever. It may delay the process, the inevitable process, but it cannot baffle it in the long run. Coal, for example, may be strongly controlled and upheld, but by reason of that very fact it will bring other fuels, particularly petroleum, into competition with it. Now, I take it that this is one of the main reasons for the demand for petroleum that has already been increasing very strongly and is likely to increase still more. We must have petroleum to take the place of the coal that is so expensive for the operation of our steamships. We must have petroleum to take the place of coal required for other purposes. We must have petroleum to obtain gasoline for the carrying on of new processes such as the operation of farm tractors, and for reducing the cost of production in fields where coal heretofore has not been used at all. It would seem to be rather clear, therefore, that the whole subject of petroleum supply, petroleum production and the petroleum industry in general is one of vital importance to the world in this juncture and the need for giving careful attention to it is one that ought not to be underestimated.

Dr. Ledoux.—I was following on the trail of Dr. Manning in some parts of Great Britain and France and can corroborate certain things that he has said. I busied myself over there particularly with petroleum, not because I am commercially or technically interested in the production or marketing of that commodity, but for other reasons. I had opportunity in Great Britain to talk with a member of the British government, with one or two members of Parliament, with bankers, with people interested in petroleum, and with others, and I found almost a mania among all the thinking people to see to it that nothing ever shall happen that will mar the present friendly relations between America and Great Britain. They said of the League of Nations, "Why, if Great Britain and America stand together in all things that will be a sufficient power to prevent war, through an economic boycott or threat of boycott or by acting as a unit with our great fleets; nothing must happen that would in any way mar the present good feelings."

One of the most prominent and influential men over there, said, "Mr. Ledoux, if you have the ear of your Government or of any influential people, please say to them that Great Britain does not want anything to happen that will mar our present friendly relations. If they see anything rising from the British side in the nature of a cloud no bigger than a man's hand, and if they will immediately call our attention to it, we shall do anything we can to dissipate that cloud before it covers the heavens."

Coming specifically to the question of oil, they recognize that oil is going to be the great national problem of all the nations. As the use of coal decreases, and the use of oil increases, the question of oil is going to dominate every other international question. They admitted that Great Britain had been somewhat selfish in acquiring prospective rights in various parts of the world. They were rather glad of the arrangement, with which you are familiar, made between the French and British governments regarding the oil concessions in Mesopotamia, which is to allow France to own 20 per cent of the interest in those fields. Several asked me, "Why cannot America do the same thing? Why cannot America as a government, or by licensing, or co-operating with some corporation existing or to be formed, join in financing these operations for the search of petroleum, and for the development of petroleum, and have a certain partnership right in the product, so that American ships going around the world would no longer have to go with their hats in their hands to British coaling stations everywhere and beg to purchase a little coal from them; so that even if America were involved in war and the question came up as to how much might be taken from a particular British-owned fuel station, the United States would be a partner, and that question in international law would probably be eliminated?"

They said, "We want you to urge this upon your Government when you have an opportunity—that whether by act of Congress, or executive order, or by having the United States charter a corporation in which it shall be interested, although the management and control of it, as far as policies go, may be in the hands of private individuals, this course should be urged, and we will do for you what we have done for France and other countries."

That feeling I found to exist in all sections, a desire of cooperation, and that suggestion seemed to me to be a very proper one. They even went so far as to say that if the United States Government cannot organize a special corporation controlled by the Government, they might enter into relations with some of the great American corporations producing oil, exercising certain control over their policies, to which the companies would doubtless gladly consent, the Government possibly backing them up, or even financing them to some extent by underwriting bonds or otherwise. They said, "Whether it be in Persia or Mesopotamia or the south shore of the Mediterranean, or elsewhere, you will find Great Britain ready to welcome you as partners."

As far as the oil situation in France is concerned, they are at present practically non-producers of petroleum. I nevertheless talked with representatives of various large producers, the Royal Dutch, the Standard and others, and they were equally eager in urging that the United States should join with Great Britain and with them in entering some financial relation with oil corporations. They said, "We don't know what to do over here; this oil question is a new problem, and needs American guidance and initiative." That is all I have to say about my observation of the petroleum situation over there, not so much from the commercial point as from the diplomatic point of view.

Mr. Church.—Some day a combination of historian and economist and, to my way of thinking, engineer, will set about the writing of a classic on the influence of natural resources, and we may discover that politics is only another word for applied economics, only we never knew it. Mr. Spurr suggested something of the sort last spring, and perhaps the economic scramble of the times will inspire the gentleman with the necessary effort to declare the thing.

Dr. Arnold.—I have been very much interested in hearing Dr. Manning's talk. I have been associated with him for a good many years in his work in the Bureau of Mines, and am glad that when he decided to leave the Government service he cast his lot with the oil industry. We heartily endorse his work of coordinating various departments of the industry as being very beneficial to this country.

Dr. Manning has said that the oil situation is serious. This is putting it rather mildly and I think we can use the word "critical" at the present time. To illustrate my point, I might say that within the last week or ten days a very critical situation arose in connection with the Mexican oil fields. One of the fields down there which is producing the great bulk of the oil that is being imported into this country from Mexico began to show signs of water. We know that three of the fields in Mexico have entirely gone to water, two of them within the last few months, and signs of water in this fourth field, which is producing so much oil at the present time, sent a chill over all oil men who are really interested in the Mexican situation. About the time that this water situation developed, there was a test well in still another field, the Zaca, that people were watching anxiously. If it struck oil it meant a new field; if it proceeded very much deeper than the depth it reached several weeks ago without striking oil, it meant that another prospective territory had proven dry. It seems that Providence must watch over us, because in the same week that the water appeared in the old field the new well came in in the new field and thus it has given the Mexican fields another lease of life.

Now, I do not think you realize the seriousness of the oil situation in regard to Mexico and the great influence that the Mexican situation has on this country. Dr. Manning told you a few minutes ago that we would probably import from Mexico this year 125 million barrels of oil; in other words, we are 125 million barrels short of enough to meet our own demands in this country (because our exports are very small as compared with our imports). The fields in Mexico are one-well fields. There is no field in the world where the Mexican conditions are duplicated. The best minds in studying out the situation there have compared the Mexican pools with underground reservoirs of oil. Punch one hole in the reservoir and you can take out practically all of the oil; punch a dozen holes and you can take it out twelve times as fast, but you can take out very little more than you can with a smaller number. When the first fields were developed down there, some of them occupied territory controlled by a single company. The Potrero Terra del Llano field is typical. Practically the whole field was owned by the Pearson interests and practically all the production of that field, about 110 million barrels, came from one well. One of the pools north of that, the Casiano, was controlled largely by the Mexican Petroleum Co., and its well No. 7 produced from 75 to 90 million barrels of the little over 100 million barrels that were produced in the northern field; therefore, those two wells have produced the great bulk of the oil from Mexico.

Compare these results with those in the third field down there, called the Los Naranjos field, where a large number of companies are operating on small lots. These lots may be ten hectares, or forty, or may be a hundred, but they are rather small blocks of land. Some of the owners were not satisfied with the development on a block of such size, and caused these small blocks to be divided up into six or seven other blocks, these being parcelled out to companies. These blocks have been developed in such a manner that possibly 150 or 200 thousand barrels of oil a day have been taken out of a very small area. That has been the case in the Los Naranjos field. Now, as soon as water shows up in any of these wells it is a pretty good indication that it is not far away in the other wells in the field. That is the record in Mexico; when one well goes to water it is the beginning of the end of all of the wells in that particular pool. This is what has made the situation so serious during the last few days, because the water has appeared right in the middle of the field in the Los Naranjos district.

Consider a field in California or Oklahoma. There you have a field divided up into sections of 160 acres and you drill one well to every five acres; it takes twenty years to get out the oil, no matter how fast it is pumped. In Mexico you could get the same amount of oil out in a few months by simply increasing the number of holes.

When you realize that, besides those mentioned, there are only three more pools left in the main prolific light oil field in Mexico, it is clear that the supply in this rich district is not inexhaustible by any means. I am not making these remarks to apply to the whole country, but in the territory which has produced all of the large light-gravity oil wells, practically one-half of the field has gone to water and about one-half or possibly two-thirds remains. This shows the serious situation as regards the oil industry when we base our hopes on Mexico.

Considering the international aspect, has it ever occurred to you that the oil industry is very provincial? It is an American industry which has been developed by self-made men who have drifted into it, not by people that have studied the subject in a broad way. The oil fields of Oklahoma have been developed in the last eighteen years and the oil fields of California, in the last twenty-two years, largely by local people. A man happened to own or lease a piece of land on which somebody thought there was oil; a company was organized, oil was struck, and immediately a new oil man would be developed. Now, that being true, it is evident that the oil fraternity is not as experienced as a whole, especially in international business, as is our own mining fraternity. I can look around here and see men who have made their reputations in South Africa, or Russia, or other parts of the world, and they are familiar with world developments. But in the case of the oil industry there are very few men in it who are familiar with foreign exploration. I think that is reflected in the way most of the work of our companies in the foreign fields is carried out. I am thinking particularly of South America and Central America, because that is where most of our exploration work is going on at the present time. The American oil operators have developed an oil industry within reach of the railroads, where the climate is good, where they have all the facilities of machine shops and the things that are necessary for carrying the work on economically. When they plunge into countries like Colombia and other parts of South America they find conditions very different, and they must gain experience before they can handle the situations satisfactorily.

It is our own fault that we have little or no interest in most of the world's new oil fields. It is because our oil men did not see ahead and did not take advantage of the opportunities that were offered several years ago to go into these countries and get a foothold. They were sure our own oil resources were inexhaustible. They laughed with derision when geologists told them our domestic supply was being rapidly and permanently depleted. Some of them are still doing it. I must say the English were more far-sighted than we were in these matters and we are paying the price. For example, I know a very large and very valuable concession in South America which was partially financed in this country. The owners needed additional capital and they made an effort to secure it here, but they could get no one to take up the proposition. All the men approached said, "We have all the oil we want ourselves, why go to South America to get more?" As the result, financial assistance was sought abroad, English money was secured, and today these owners are being criticized because they went abroad and permitted the English to obtain control in that country. We have now awakened, and are facing the problem of our decreasing oil supplies. This idea of Dr. Manning's, to form an oil entente, is a very good one. I think it is particularly fine from our viewpoint. We have 18 per cent and the other fellow has about 82 per cent; let's go into partnership with him and divide fifty-fifty. Possibly Dr. Manning can accomplish this great task; I think he can do it if any one can. He is a natural-born diplomat and I think we owe him a vote of thanks for the energy he has put into his work in trying to put America on the map as regards the international oil situation.

A Voice.—I should like to ask Dr. Arnold to tell us specifically what he is doing in regard to finding oil outside of the United States. I personally know he is doing more than anyone in America in finding oil in foreign lands.

Dr. Arnold.—That is hardly fair because I am really doing very little. I am trying to do something, but it is pretty hard to accomplish things when the attention is riveted somewhere else. The case of the Canadian oil fields to which I assume the speaker refers, is one that has been before the American people since 1914 when there was a big oil boom in western Canada. A great deal of money was wasted in explorations, on structures, and under conditions that were not favorable for the accumulation of commercial quantities of oil. But at the same time you can hardly say that any dry hole is a waste, because it usually gives us some information. Out of that Calgary boom has grown a real interest in the oil possibilities of western Canada. You have noticed in the papers in the last two or three days an account of a strike at Fort Norman. I think it is inside the Arctic Circle. Anyhow, it is in a territory where it has required two or three months to take in the supplies and where the men have had to go into winter quarters in order to build their rig and carry on drilling operations. The work has been rewarded by a strike of very high-grade oil and will result in the development, I believe, of an oil of considerable magnitude. Just stop and consider the difficulties that will surround the marketing of that product. They will have to build a pipe line 1,500 miles long through practically a swamp. The northern territories of Canada are full of muskeg, lakes and rivers and the conditions of transportation are exceedingly difficult. It will be years before that strike will help us any.

Further south, we are carrying on some developments looking toward the opening of a field in Alberta and western Saskatchewan. A great deal of money is being invested there at the present time and a number of wells are reaching depths that the geologists claim ought to bring them into the oil horizon very soon. That is just one of the fields that is being developed by American capital; first, through the Imperial Oil Co., which is the representative of the Standard Oil Co. in Canada, and by a number of syndicates of Americans who have gone up there.

Two years ago I had a talk with Sir Augustus Nanton, who is connected with a large number of corporations in Canada, and when I asked him if he was interested in putting money into a proposition to develop the oil fields there, he said: "No, I am not; the Canadians put all the money they had into the war. I hope you can get a lot of United States money to put into the development of those lands. I realize their value, the great possibilities and the enormous profits that would be made if oil were struck, but we are practically at the end of our rope and I hope the Americans will come up and help us develop our resources." I think that shows a spirit of international co-operation that should be developed with all of our English-speaking brothers. As Sir Augustus was a Canadian, I think it reflects the spirit of the Canadians anyhow. I think that Dr. Manning and Dr. Ledoux said they found something of the same spirit in Great Britain. I hope we shall develop this spirit, because they certainly have the edge on us in the undeveloped oil deposits as we know them at the present time.

Dr. Manning.—Dr. Arnold requested me to speak of the value of technologists and geologists. At a luncheon today given to one of the principal executives of the Dutch Shell Co. one of the gentlemen asked me my opinion of the value of the geologist or the oil technologist to the oil industry. I said, "Around this table are not millions of dollars but billions represented by the men present." The significant fact was that there was not a single company represented that did not have geologists by the score. One of them had 108 geologists. While it is true that the development of the oil industry in the United States was made by the men who owned the land, at the same time they made the developments through the aid of geologists or were in territory which had been developed.

Mr. Church.—Dr. Arnold, I have a question to ask in regard to the attitude of whatever Mexican government is in power at the present time and the prospect of necessary laws or proper laws for the continued development of Mexican fields. Some little time ago a theory was presented in the newspapers about the rather hostile attitude of the Carranza government which has since been replaced and there has been some report of improvement. Can you tell us something of that?

Dr. Arnold.—That opens up a subject that is very interesting to me and ought to be to all of us—the question of the relation of the Mexican government to the American oil companies operating in Mexico. I have some very decided ideas about that question because I have been interested in it from two angles; first, as one who is carrying on professional work in the oil fields of Mexico; second, as one interested in the man whom the Mexican government has chosen to try to work out the problems and the difficulties that have arisen between the government and the American oil companies. I refer to Mr. Garfias. He is a Mexican who came to this country when he was eighteen years old and couldn't speak a word of English. He attended preparatory school in California, finally entered Stanford University from which he was graduated. Shortly after his graduation I had the good fortune to secure his services as an assistant. He was with me for five years and showed a wonderful adaptability to all the conditions the geologist and the oil engineer have to meet. He then taught at Stanford University for two years. During those years he was one of Dr. Manning's official family; that is, he had a connection with the U. S. Bureau of Mines, and I know Dr. Manning thinks very highly of him. All this time he kept his Mexican citizenship and was always very loyal to his mother country.

At the time of the overthrow of the Carranza government, or shortly thereafter, Mr. Garfias was called to Mexico by the Obregon element, with which he had always been friendly, and was asked to take up this task of trying to work out a scheme for bringing about friendly relations between his government and the American oil companies. He came back to New York, called a meeting of the representatives of all the companies, laid his credentials before them, and asked them for suggestions as to a method of procedure to bring about the desired results. He had the support of practically all of the companies, but there was one element that was disinclined to co-operate with him, and that element is fighting shy today of co-operation with the Mexican government.

I know that if we had large deposits of oil in this country and some foreigners came here, took advantage of our ignorance regarding oil and made contracts that were decidedly one-sided, later on if we had the authority we would try to equalize matters in connection with an industry of that kind, which is vital to the nation. I think that there are arguments on the side of the Mexican government in asking for a revision of some of the contracts that were made. A contract is a contract, of course, but I think it is a rule of law that when a contract is absolutely one-sided and absurdly insignificant, or no consideration is given on one side, it can be invalidated. I hold no brief for the Mexican government for the way it treated the American oil operators during the Carranza régime, but I believe the present government is friendly; that it wants to work out a scheme that is just and right for the American operators, but that it wants to do it with the idea that Mexico is to get some of the benefit of the development of its natural resources. I think this idea should be given serious consideration.

I think there is no question that the Mexican government can tax the oil operators to any extent. All you have to do is to look at the way our own Government treats its oil operators. If the Mexican government treated them as ours does there would be an outcry. Take the Osage country of Oklahoma where the oil is held by the Indians. Naturally the Government wants to protect them and I think it has protected them fully. Dr. Manning knows the situation and I think he will say the Government has taken care of the Indians and it is taking care of its oil resources in the Western states. There has been a fight on in Congress for many years on account of the Leasing Bill and when the royalties imposed by the Government are carefully studied you will find the Government is getting the best of it in every case. The Mexican government has only to find out how our own Government is treating the oil operators and apply the same rules down there, and we would find harsher rules than Mexico has applied up to the present time. I think the Mexicans are trying to treat the oil operators fairly and it is only the actions of a few of the operators down there that are retarding the settlement of this whole matter.

Dr. Chance.—I should like to ask Dr. Manning where, outside of Mexico and South America, the most prominent fields exist.

Dr. Manning.—I shall have to quote the geologist again in connection with the Eastern Hemisphere, for the Trans-Caucasia area is more promising than anywhere else in the world. Of course there have been developments in British Mesopotamia. Roumania, Galicia, but my dream, which has been considered a Utopian dream, is to encourage the oil people to buy all the property they can through a foreign corporation and be the pioneers in the unexplored regions of the Far East.

Mr. Church.—Dr. Manning, in presenting the constructive side of your paper this evening, you raised the question in my mind as to whether there was anything which the Mining and Metallurgical Society could do and the New York Section could suggest for the Society to do in furtherance of the thing you had in mind.

Dr. Manning.—No, there is nothing. I presented the oil question tonight because I do not think there is anyone present who is not interested directly or indirectly in the production of oil throughout the world. So I think it is a problem that we all want to begin to think about seriously and co-operate in to the fullest extent, but there is nothing that I can see that this Section can do or anybody can do except the oil men themselves in instituting some governmental policy; therefore I have asked them to formulate a policy and I will do the utmost to get it through Congress. Republicans and Democrats have said, "If the Administration will tell us what to do, we will try to do it." It is up to the oil men, in my opinion, to make the next move in promoting a constructive oil policy by our Government.

[Dr. Manning stated that the American Petroleum Institute was shortly to hold a meeting in Washington, and that he would be glad to receive any problems or suggestions that may occur to the Society.]

Dr. Arnold.—I should like to suggest that the Mining and Metallurgical Society, if it be agreeable to the American Petroleum Institute, send a representative to its meeting in Washington.

Dr. Manning.—The American Petroleum Institute is going to hold its first annual meeting Nov. 17-19 in Washington. It will be international in character. Cablegrams have been sent to the twenty-one countries to send representatives to Washington to consider the production of oil, and the world's petroleum problem from an international standpoint. I hope at this time we can get these people together and remove certain discriminations that exist practically through seventeen of the twenty-one countries. You are all invited to come. It is going to be a meeting which we want everybody to attend and listen to the discussions and contribute to it as far as possible.

Mr. Church.—In answering Dr. Manning's very kind invitation, and particularly his suggestion of an official representative of the Mining and Metallurgical Society, it is, of course, necessary for the Council to take the action, but it is the privilege of the New York Section to formally present the suggestion to the Council, and I am going to suggest that the Secretary of the Section send a copy of the minutes, or such part of the minutes as may be necessary, to the Council to inform them officially of the suggestions of Dr. Manning and Dr. Arnold.

After a rising vote of thanks to Dr. Manning and the other speakers of the evening, the meeting adjourned at 9:30 p. m.

Mining and Metallurgical Society *of* America

Vol. XIII, No. 7 December, 1920 Bull. 143

ANNUAL MEETING.

The annual meeting of the Mining and Metallurgical Society of America will be held at the Columbia University Club, 4 West 43d Street, New York, on Tuesday, January 11, 1921.

The first session of the meeting will be called at 2:00 p. m., and the second session at 8:30 p. m., preceded by the usual informal dinner at 6:30 p. m.

SHALL THE M. M. S. A. JOIN THE FEDERATED AMERICAN ENGINEERING SOCIETIES?

In accordance with instructions from the Council, the Secretary, on Dec. 18, issued as a referendum to the entire membership a statement with regard to joining the Federated American Engineering Societies, together with letters for and against the question. At the same time the matter of dues for 1921 was presented, and members were asked to vote on the following questions:

(1) Shall the Society join the Federated American Engineering Societies in the event that funds can be provided for the purpose?

(2) Dues.—The Council is very reluctant to ask for voluntary contributions to support the Society during the year 1921 as it did in 1920. In order to avoid this dependence, do you favor raising the dues for 1921 to $16.50 in the event of No. 1 being approved; or $15 in the event of No. 1 being disapproved?

The statement and letters follow:

The Joint Conference Committee of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, assembled in Washington on June 3-4, 1920, extended to the Mining and Metallurgical Society of America a cordial invitation to become a charter member of the Federated American Engineering Societies, which was then in process of organization.

This organization has been created and is now functioning. Its object is: "To further the public welfare wherever technical knowledge and engineering experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions."

The Federation consists of societies and affiliations, and not of individual members.

The membership of the Federation at the time the Council gave this subject consideration included the following societies, and since that date six other organizations have become members:

American Institute of Mining and Metallurgical Engineers; American Institute of Electrical Engineers; American Society of Mechanical Engineers; American Institute of Chemical Engineers; American Society of Agricultural Engineers; Society of Industrial Engineers; Detroit Engineering Society; Technical Club of Dallas; Cleveland Engineering Society; Engineers' Association of Nashville; Engineering Society of Buffalo; Alabama Technical Club; Kansas Engineering Society; Florida Engineering Society; Grand Rapids Engineering Society; Iowa Engineering Society.

On Aug. 16 the invitation of the Federation was sent to all members of the Council of the Mining and Metallurgical Society with the request that they advise the Secretary as to whether the invitation be accepted or declined. The replies showed that Councillors were not in agreement. At the Council meeting of Nov. 10 the matter was thoroughly discussed, but the Council was not able to accept or decline the invitation.

By unanimous vote the Executive Committee was instructed to prepare a referendum setting forth the arguments for and against the Society's becoming a member of the Federation to be submitted to a full membership vote. At the same time the Secretary was instructed to inform the members of the Society's financial condition and its requirements for 1921, and submit also to vote the matter of dues for the year 1921.

Herbert Hoover, Allen H. Rogers and members of the Council have submitted the following communications for and against the Society's becoming a member of the Federation:

Herbert Hoover.—The time has arrived in our national development when we must have a definite national program in the development of our great engineering problems, all of which cry out for some broad-visioned national guidance. We must create a national engineering sense of provision for the nation as a whole. If we are to develop this national sense of engineering and its relations to our great human problems, it must receive the advocacy of such institutions as this. The F. A. E. S., composed of the various engineering societies, represents the engineers of the United States.

It is our duty as citizens to give voice to those critical matters of national policy which our daily contact with this, the fundamentally constructive profession, illuminates to us. Just as our medical associations voice the necessity of safeguards to national health; as the bar associations offer safeguards to our judiciary, so the engineers should exert themselves in our national engineering policies. We have none; but we need some, or the next generation will face a lower instead of higher standard of living than ours.

Individual initiative is insufficient because the problems involve political, financial, interstate matters beyond individual ability. The problems involved are beyond individual initiative alone. We must have a national conception and national guidance. Co-operation by united effort instead of parallel effort not only promises greater good to the profession but seems to be the unanimous will of the engineering profession of the country as evidenced by the June convention in Washington and the subsequent action of the engineering societies throughout the country.

The Federated American Engineering Societies is of such portent that it seems to me real co-operation can be accomplished in full measure only by membership in it, and only by such combined action can we secure the measure of public service we all desire.

The object of this organization as stated in the constitution is "to further the public welfare wherever technical knowledge and engineering experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions."

Here is the opportunity for the engineering profession to show its solidarity and accept this opportunity to perform its duty to the nation, which duty rests upon the profession as a whole and cannot be performed by any component part in an individualistic effort.

Allen H. Rogers.—With reference to conversation with you regarding action of the Society on the invitation to join the Federated American Engineering Societies, I hope the result of the Council's deliberation may be acceptance of the invitation.

The principal object of the Society is action on public questions, and as this is also the primary object of the Federation, an organization that is nation-wide in its scope, I cannot see how the Society can consistently stay out. The fact that the Society, due to its comparatively small number, would have fewer delegates than many other organizations is offset by the excellent record the Society has made in action on such public questions. Its membership in the Federation would not preclude its taking action as a society on any question that might arise, and I believe, on account of its record, such action would influence American Engineering Council out of all proportion to the representation which the Society might have thereon.

It is true that almost without exception Society members are members of other organizations, and through these organizations will already be charged with the assessment for expense of the Federation. As members of the Society they are, of course, subject to a second assessment, but I believe that the bulk of the membership have the same pride in the existence of the Society as an organization as I have, and will not complain at the paltry amount which is necessary to put the Society on a par with the other engineering organizations of the country.

F. G. Cottrell.—As I shall very likely be away in the West at the time of the meeting of the Board in September, I am dropping you this line in answer to your letter of Aug. 16 to say I am fully in favor of the Society's becoming a member of the Federated American Engineering Societies, as my impression is that this really represents the essentially unanimous movement of the engineering profession at present and has been worked out in about as careful and practical detail as can be expected for the initial step. It deserves the support, in its present form, of the organizations which it attempts to unite.

W. R. Ingalls.—I am in favor of the Mining and Metallurgical Society of America joining the Federated American Engineering Societies. The Mining and Metallurgical Society has stood since its organization for the organized participation of engineers in public affairs. We ought to join the new Federation in order to be true to our own aims and purposes. In so joining we shall not lose any of our independence or right to take separate action with regard to any public matter.

By joining the Federation we shall have to tax our financial resources, already slender, to the extent of $1.50 per member. Nevertheless, it seems to me that participation by us in the Federation is of such importance that we must face this additional burden and raise the necessary money in some way.

Horace V. Winchell.—I am in favor of joint effort by engineers in every activity which concerns their common interests, and I believe that after careful consideration by competent men the best instrumentality for exerting joint effort has been evolved. For this reason I am heartily in favor of joining the Federated American Engineering Societies.

R. C. Gemmell.—I believe the objects of the Federation are worthy and commendable; that there is need for just such an organization, and that it would be to the advantage of the Society to become a member. Therefore, I think the invitation to join this organization of engineering societies should be accepted.

Ralph Arnold.—I have your letter of Aug. 16th regarding the Mining and Metallurgical Society becoming a member of the Federated American Engineering Societies, and am heartily in favor of its so becoming.

Waldemar Lindgren.—Referring to the advisability of the Mining and Metallurgical Society of America joining the Federated American Engineering Societies, I beg to submit the following:

While I have no doubt as to the beneficial results which may be obtained by co-operation among engineers, I would suggest that until the aims and purposes of the Federation are more fully established it might be just as well for the Mining and Metallurgical Society to stand apart. That the plan is not universally approved I infer from the fact that the large Society of Civil Engineers has recently refused to join. The purposes of the proposed association are evidently in large degree political, and I believe it is not at all certain that our Society would subscribe to the various moves which are in contemplation. In addition, there has developed a considerable diversity of opinion among our members in regard to this subject, and considering everything, I believe that this is a matter in which it would be well to proceed slowly, and with due deliberation.

R. A. F. Penrose, Jr.—I object to accepting the invitation to join the Federated American Engineering Societies for the following reasons:

(1) Such action would add considerably to the expenses of the Mining and Metallurgical Society, and at the present time it is in no condition to incur additional expenses. In fact, we all know that last year the Council asked for voluntary contributions in addition to the regular dues. If we accept the invitation the regular dues would doubtless have to be increased.

(2) Probably every member of the Mining and Metallurgical Society is also a member of one or more of the other societies which have joined the Federated Societies, and in this way they secure advantages which would accrue to them if the Mining and Metallurgical Society should join the Federated Societies.

(3) The very small membership of the Mining and Metallurgical Society, as compared with the immense membership of some of the other societies which have joined the Federated Societies, would prevent the

Mining and Metallurgical Society from having any noticeable influence in the affairs of the latter organization.

(4) The Mining and Metallurgical Society was originally started to carry out certain ideals in their profession, because they did not find these ideals fully manifested in other organizations. If it should join the Federated Societies its identity and usefulness would probably be largely decreased and its membership might fall off.

J. V. N. Dorr.—I agree with others that while the object of the Federation is of the greatest of value to the country, there will be no advantage to the Mining and Metallurgical Society as a whole to belong to it, as its members already express themselves through the other societies joining.

H. H. Knox.—With reference to the question of joining the Federated American Engineering Societies, I see the matter in its essential aspects as follows:

(1) The complaint is frequently heard that the multiplication of scientific and technical organizations has reached such a point as to occasion a substantial drain on the purse of the man of moderate means. It has been the policy of the Council to respect this situation by limiting the expenses to the minimum necessary to carry out the objects of the Society. Therefore every increment to the dues of any organization should be scrutinized from this standpoint.

(2) The mineral industry is already represented in the Federation by the A. I. M. E. If the Society were to join the Federation its representation would be too insignificant to exert much influence on the general policy of the latter.

(3) At the moment there is no certainty that the policy of the Federation will in all respects harmonize with that of the Society; there is no assurance that the peculiar aims of the Society would not best be served by isolation. No harm could result from a postponement of action for a year or two when we may expect somewhat more enlightenment on the subject.

Member of Council.—I have read the constitution and by-laws of the Federated American Engineering Societies and it is my opinion that our Society should not apply for membership. It will simply add to the financial burden of the Society to the extent of $1.50 per annum for dues for each member without attaining any results which would not be forthcoming by virtue of membership through the A. I. M. E., to which I believe practically every member of our Society belongs.

The most important function of the new organization, it strikes me, is that of obtaining publicity for the views of its constituent societies in connection with public affairs and I believe this to be highly desirable in order that the engineers of this country may have at least as influential a standing as, for instance, the plumbers. This is a point which has been overlooked for a long time and the reason for it, perhaps, lies in the nomadic habits of the average mining engineer, and, to some extent, similar habits, of civil and electrical engineers. It should be corrected and I believe that the new organization will be of great aid in this particular; nevertheless, I think the same results could be obtained without burdening our small Society with the additional expense.

PRESENTATION OF GOLD MEDAL TO E. A. CAPPELEN SMITH.

The gold medal of the Society for 1920, awarded to E. A. Cappelen Smith for distinguished services in the art of hydrometallurgy, was presented at a dinner on Wednesday evening, Nov. 10, 1920, at the Hotel Commodore, New York, at which the following members and guests were present or represented:

Alence, Mr. R.
Alexander, Mr. and Mrs. H. H.
Aller. Mr. and Mrs. F. D.
Anderson, Mr. J.
Arnold, Dr. and Mrs. Ralph
Barrows, Mr. Frank E.
Bartholomew, Mr. G. P.
Bellinger, Mr. and Mrs. H. C.
Benedict. Mr. W. DeL.
Bennett. Mr. W. E.
Berry, Mr. E. S.
Birch, Mr. Stephen
Brown. Mr. and Mrs. Frederic C., and two guests.
Brownell, Mr. F. H.
Brush, Mr. Hamilton
Burdick. Mr. C. A.
Burdick. Dr. G. L.
Burrage, Mr. A. C., Jr.
Catlin. Mr. R. M.
Channing, Mr. J. Parke
Church, Mr. and Mrs. J. A., Jr.
Clendenin, Mr. Joseph
Clevenger. Mr. G. H.
Condon. Mrs.
Davis. Mr. William H.
Demarest, Mr. John M.
Dougherty, Mr. Nelson
Drew, Mr. and Mrs. C. V.
DuBosque, Mr. Frank L.
Dwight. Mr. and Mrs. A. S.
Earl. Mr. Charles
Edmonds. Mr. Dean S.
Eilers, Mr. and Mrs. Karl
Eilers, Miss Marguerite
Fink, Dr. Colin G.
Foraker, Mr. Burch
Foraker. Mr. F. R.
Fredrick, Mr. Leopold
Garland, Mr. N. M.
Garlichs. Mr. H.
Gottsberger, Mr. B. B.
Green, Mr. L. M.
Guggenheim, Mr. Edmond A.
Guggenheim, Mr. Harry F.
Guggenheim, Mr. S. R.
Hansen. Mr. C. A.
Hertzwig, Mr. Olaf N.
Hoerr. Mr. W. D.
Holden, Mr. L. C.
Holter, Mr. Edwin O.
Horn, Mr. and Mrs. F. J.
Hull, Mr. and Mrs. M. R.
Ingalls, Mr. W. R.
Jones. Mr. T. I.
Kelley, Mr. C. F.
Kemp, Prof. and Mrs. J. F.
Kiddle. Mr. Alfred W.
Koch, Mr. and Mrs. E. V. H.
Lalor, Mr. and Mrs. John
Leggett, Mr. Thos. H.
Liddell. Mr. and Mrs. Donald M.
Lie, Mr. Jonas
Lima, Mr. and Mrs. Edward de

Lindgren, Dr. Waldemar
Lloyd, Mr. and Mrs. R. L.
Ludlum, Mr. A. C.
McQuatters, Mr. A. J.
Malone, Mr. J. R.
Marsh, Mr. Robert, Jr.
Marvin, Mr. Arba B.
Mathewson, Mr. and Mrs. E. P.
Martin, Mr. and Mrs. O. C.
Mayer, Mr. Lucius W.
Mayer, Mr. Paul H.
McCarthy, Mr. E. E.
McClenahan, Mr. and Mrs. J. S.
Mein, Mr. W. W.
Meissner, Mr. and Mrs. Carl
Merchant, Mr. E. H.
Metzger, Mr. Samuel
Meyers, Mr. Clarence L.
Monrath, Mr. and Mrs. G.
Morse, Mr. and Mrs. W. S.
Morton, Mr. W. Brown
Motter, Mr. W. D. B., Jr.
Pennie, Mr. J. C.
Perry, Col. O. B.
Potter, Mr. W. C.
Pratt, Mr. Addison S.
Prosser, Mr. and Mrs. H. A.
Richards, Prof. R. H.
Robbins, Mr. Hartley
Rogers, Mr. Allen H.
Rose, Mr. C. A.
Rutherford, Mr. and Mrs. Forest
Rygg, Mr. A. N.
Sage, Mr. Merton W.
Savage, Mr. Edward
Scheffler, Mr. Fred A.
Sharpless, Mr. F. F.
Shults, Miss Isabel
Silkworth, Mr. Wm. S.
Skougor, Mr. H. E.
Smith, Mr. and Mrs. E. A. Cappelen
Spurr, Mr. and Mrs. J. E.
Steele, Mr. John N.
Smith, Mr. and Mrs. Wm. Allen
Talbot, Mr. T. H.
Thatcher, Dr. H. C.
Thomas, Mr. C. G. M.
Thomas, Mr. P. H.
Thomson, Mr. G. G.
Thomson, Mr. Sam
Tower, Mr. and Mrs. George W.
Ulrich, Mr. C. T.
Van Keuren, Mrs. M. M.
Voorhees, Mr. and Mrs. H. B.
Walker, Dr. A. L.
Webb, Mr. H. H.
Weld, Mr. and Mrs. C. M.
Westervelt, Mr. and Mrs. Wm. Young
Weymouth, Mr. Aubrey
Whitley, Mr. C. W.
White, Mr. Robeson T.
Yeatman, Mr. Pope

E. P. Mathewson acted as toastmaster, and in beginning the proceedings referred to Mr. Smith in his usual humorous vein, and read a letter from Mr. Daniel Guggenheim, and a telegram from Mr. Morgenstern of the Norwegian Legation. He then introduced Professor Arthur L. Walker, who was in charge of the Perth Amboy plant when Mr. Smith was connected with it.

Arthur L. Walker.—When I was asked to speak this evening on the subject assigned to me, I thought I would have an easy job in being able to say nice things about Cappelen Smith, our guest of honor. But after visiting the public libraries and looking up all the official records available, I found the proposition a most difficult one, for the reason that it is impossible to say all I wanted to in the two-hour period allotted to me.

I would like to go back to his boyhood days in Norway and touch on the wonderful things he accomplished when a mere child. I would like to go back to his college days when he entered the Polytechnic Institute at Trondhjem, where his professors, by the use of *basic* principles, were able to *convert* him into a full-fledged engineer. I would like to tell you why he finally made up his mind to come to this country, but time does not permit.

When Smith arrived in this country, he went to Chicago, being an adventurous lad, to visit the World's Fair. He was first engaged as assistant chemist by Armour & Co., but as the cold storage proposition evidently did not appeal to him he entered the services of the Chicago Copper Refining Co., and has been intimately connected with the copper industry ever since.

Why he specialized in copper I was not able to ascertain, but it has been rumored that the following incident had something to do with his selection: A certain promoter had devised a scheme for extracting copper from a simple solution of iodine. On submitting this solution for examination, Mr. Smith, who was an expert chemist, could not find a trace of copper in it. But on immersing in this same solution a bar of iron the bar was immediately coated with real copper. The experiment was repeated a number of times and with the same result. Smith was never able to detect any copper in the solution, and he evidently came to the conclusion that if copper could be found where none was present, that was the profession for a venturesome young man.

Finding the atmosphere of Chicago rather confining, however, he decided to follow the advice of Horace Greeley and go West. Anaconda was his destination, where he became associated with the Anaconda Copper Mining Co. For several years he served as superintendent of the electrolytic copper refinery and of the smelter. While at Anaconda, Smith developed many original ideas, which, unfortunately for the Anaconda Company, were so far in advance of the time that the suave, placid, and always even-tempered Marcus Daly could not see their value. Whether it was on account of being discouraged in his efforts to convert the officials of the Anaconda company to his new ideas or for other reasons, the records do not state. But Smith left Anaconda and went further West.

During his stay in Anaconda, however, he made for himself a name as a brilliant, energetic and most generous man. His successes were numerous, but by far the greatest of these was when he was finally able to persuade a certain young lady to become his wife and share his wanderings, vicissitudes and triumphs with him. After wandering around a short time, visiting several places and meeting some of our important engineers, Smith came to the conclusion it was time to pay some attention to the East, and he became associated with the Baltimore Copper Smelting & Rolling Co. as consulting metallurgist. With this company he stayed for a number of years—

I won't say how many. In Baltimore he was able to give full rein to his numerous plans and projects and in working them out many were found to be successful; but one, as I will mention later, was a dismal failure.

About 1904, while I was cruising around Baltimore looking up some of my old friends, I was asked by Mr. William H. Peirce, later president of the Baltimore copper works, to step down to the plant and see a new contrivance Mr. Smith and he had gotten up. Having always been interested in the Baltimore plant, I went down there and found that they had a contraption composed of a so-called furnace, consisting of a stationary fire-box, a horizontal rotating cylindrical furnace equipped with converter tuyeres and a stationary flue, the idea being to smelt ore in this apparatus and then convert the resulting matte. Now, metallurgists have always been a little skittish when any project like this has been brought forth. There are difficulties in smelting, there are difficulties in converting, and when a two-in-one piece of apparatus is suggested they are rather shy of it. Many plans have been suggested for doing this, but up to the present time none has been commercially successful. This special piece of apparatus, however, was like the little couplet used to advertise Ford cars, "for when they blew it in, the darn thing ran." The principal features were the special basic lining in the rotating cylindrical furnace and the novel arrangement of the tuyeres through which air was blown into the charge. It was soon seen, however, that while smelting could be accomplished in this converting furnace and matte also successfully blown to blister copper, the principal advantage was in using it as a converter. The design of the tuyeres was such that they were sufficiently rigid to last and cause no trouble. The lining was constructed in such a manner that it was not displaced, broken or corroded and served for many charges, instead of only three or four blows in the silicious-lined converter previously used. From this machine, minus the stationary fire-box and flue, the Peirce-Smith basic-lined converter was developed, and it was so successful that it has revolutionized former practice and has entirely displaced the silicious-lined converter all over the world.

This piece of apparatus was not perfect and it required an enormous amount of work to develop it. This was not done without considerable labor and for years Mr. Smith devoted a great portion of his time to the development of the art of basic converting for copper matte. The successful outcome of that process is largely due to his untiring energy and ability to meet difficulties which always occur in working out such a process.

As success was attained, some said, "Why, we had that idea and made experiments in basic converting." That may be true, but none of the previous experiments was successful—something had been wrong or something was lacking. It seems to me if a succession of failures result from attempts to accomplish a certain result, all the more credit is due to those who by better understanding of what is required and by the use of improvements found necessary, make a complete success of an idea that has been a failure in the past. It is not necessary to mention in detail the technical advantages resulting from the introduction of this converter. They are many. As much as 100 tons of copper is now produced in one charge and as much as 35,000 tons for one converter lining, but these advantages are directly reflected in reduced cost of operations. Their extent can be readily comprehended by the simple statement that after the introduction of the basic converting process the cost of producing blister copper from matte was cut in half.

There were many other things that Mr. Smith accomplished while in Baltimore and I would like to dwell on them if time permitted. But it is now necessary to record what may be termed a partial failure of rather a sad nature, the result of another research conducted by Mr. Smith. The basis of this research was that if a man wore a straw hat without any crown his hair would become thicker and last forever. I have been reliably informed that for a long time in Baltimore Mr. Smith wore straw hats of numerous vintages, without any crown, and look at the result! Our genial toastmaster had another idea, and conducted an entirely different research. He used the effect of the solar rays as projected through a screen of blue glass. I leave you to judge which has proved most efficacious.

A little later—I am omitting all dates by request—the officials of the American Smelting & Refining Co. thought it was time that Smith saw something of this town and he came to New York and entered the service of the smelting company as consulting metallurgist. Soon, however, his services were corralled by M. Guggenheim's Sons, who have a faculty of knowing a good thing when they see it. One of his first investigations in this new connection has been characterized as audacious, presumptuous, and, to a certain extent, idiotic. This was to devise a process which involved an entirely new metallurgical proposition, and to design a plant to treat ten thousand tons of material a day from an orebody where two hundred million tons had been developed, using for this purpose a small lot of only six hundred tons of ore to make his experiments which extended over a period of more than one year.

I am not going to dwell on the subject of the Chuquicamata operations; they will undoubtedly be touched on by one of the following speakers, if he gets a chance, who is more familiar with the actual working of that property than I am, but as I was consulted about this proposition rather early in the game I can not resist the temptation to say a few words about it. Many attempts to work the Chuquicamata property and treat its ore had been undertaken, the experiments extending over a period of years and being conducted by several different companies, but none of them was successful and no feasible method had been found for working the ore until the plans devised and proposed by Mr. Smith were put in operation. The *Engineering and Mining Journal,* in publishing these plans, editorially congratulated the Chuquicamata staff on the originality and boldness of the scheme, hoping that it would result in one of the great metallurgical triumphs of the age. The wishes expressed in that editorial came true, and the process developed by Mr. Smith, working only on that small lot of six hundred tons of ore, has been found thoroughly practical, efficient and profitable in a plant treating ten thousand tons or more a day.

I have just received an S. O. S. by wireless from the toastmaster, informing me that I entirely misunderstood the program. The period of two hours was not allotted to me, but to the entire performance. . . . .

It is a great privilege to have been called on this evening to participate in these proceedings and to join with you in honoring our friend, Cappelen Smith, an engineer who is a credit to our profession, who has made a wonderful record for himself, and whose contributions to the art and science of metallurgy have been well worth while.

[The toastmaster then read a cable from the Chuquicamata staff and telegrams from Edwin S. Berry and Pope Yeatman, associates of Mr. Smith in the development of Chuquicamata, congratulating him on the honor of being awarded the medal, after which he introduced Harry F. Guggenheim.]

Harry F. Guggenheim.—I suppose each generation has its own feelings and I must confess that mine were quite different from those of Mr. Walker, when I was honored by the request to address you this evening on the occasion of the distinction which the Mining and Metallurgical Society of America has seen fit to confer on my friend and associate, Mr. Cappelen Smith. I felt that if there were truth in the Scripture—"A prophet is not without honor save in his own country and his own house," I would do but poor justice to this occasion. For Mr. Cappelen Smith has been a prophet; in fact, such a bold and unequivocal prophet, that I think were some of the "prophetes" of the Oracle of Delphi with us this evening to hear me repeat the Smith prophecy, they would rush from our midst to call a meeting of the Prophets' Union for the purpose of suspending Mr. Smith and preventing his practice in the future. I think that perhaps no one else, unless it be Mr. Pope Yeatman, has a more intimate knowledge of Mr. Smith's accomplishment than myself, and in spite of the proverbial bias to which I have referred, I am sure that no one can feel more heartily than I that never was an honor more richly deserved than this one.

By means of Mr. Smith's creative genius it has become possible to treat commercially the ore from the Chuquicamata mine, the direct result of which is the employment of some four thousand workmen daily, and at the rate at which this ore is being mined, four thousand men will be employed at this work daily for the next one hundred and twenty-five years. The indirect results of this development would, if followed to anything near finality, fill many volumes. I can visualize a few of them.

In Chuquicamata there was, in 1911, a huge desolate mountain of low-grade copper ore, deserted because practically all of the metal that science could extract at a profit from this mountain had been recovered. On all sides was a great barren waste as far as the eye could see. Today this mountain of copper is no longer desolate; it is overrun with railroad tracks and trestles, dumps and fills, drill rigs, steam locomotives, ore and waste cars, and steam and electric shovels. On the barren waste adjacent to the mountain there has been built an industrial plant that covers many acres. Beyond is a modern mining village with its churches and schools, playgrounds, shops and hospitals—with its disappointments and hopes.

When the problem of the treatment of the ore from this mine was attacked by Mr. Smith there was little help to be had from former metallurgical practice. Probably the best proof of this is the fact that the Chuquicamata deposit had been known for many years by the mining profession to contain a large quantity of ore, but it was considered valueless on account of its character. In an article prepared some years ago by Mr. Fred Hellmann he made this pertinent comment:

> For many years past, perhaps more than a century, this deposit has attracted the attention and interest of all who have seen it, for on its very surface it carries the announcement that here copper is to be had, by reason of the striking color of its predominant mineral.

As far as is known, the mines were first worked by the Inca, and after the Spanish invasion, by the Spaniards.

In modern times, as early as 1900, Mr. W. S. Morse went to

Antofagasta, the district in Chile in which Chuquicamata is situated, on behalf of the firm of M. Guggenheim's Sons, to investigate the Antofagasta smelter which was then being operated by that firm. Mr. E. P. Mathewson, who was in charge of the Antofagasta smelter, and Mr. Morse jointly visited the Chuquicamata property. I asked Mr. Mathewson recently of his recollection of that visit. He said:

> I told Morse that the property could be bought for £45,000 and that I thought it would pay to buy the property for the purpose of working the vein mines to the east of the great low-grade portion called the "llampara," and suggested that he refer the matter to M. Guggenheim's Sons. Morse laughed and said, "I won't waste a postage stamp on it."

In 1917, Mr. Morse went to Chuquicamata, and evidently remembering his visit with Mr. Mathewson in 1900, wrote him a letter from which I quote the following:

> The world is certainly moving fast, as neither you nor I would have given much real money in 1900 for the entire hill containing the "llampara" which is now selling for something over $100,000,000 on the New York Stock Exchange.

It will be impossible, I am sorry to say, to go into the metallurgical details of Mr. Smith's accomplishment now. I wish, however, to summarize the general important results.

Mr. Smith started his experimental work in the late fall of 1911 and continued it zealousy for three years. A small experimental plant was built and started operating in the fall of 1912 (Mr. Walker has told you how very small this plant was), and in the spring of 1913 experiments had progressed so far that designs for a permanent plant were begun.

The Chuquicamata plant was partially put in operation in May, 1915. The first forecast giving expected results from treatment were contained in a report dated April 2, 1913, in which Mr. Smith stated: "Our results show that we shall recover as electrolytic copper 90 per cent of the copper contained in the ore." He also predicted that: "The quality of the copper will be equal to electrolytic copper of the highest grade."

In regard to the extraction, the prediction was made that 90 per cent of the copper would be extracted, based on an ore averaging 2 per cent copper. For the first nine months of this year the average copper contents of the ore delivered to the treatment plant has been 1.53 per cent and the extraction has averaged 89.43 per cent. This, remember, on a head of 1.53 per cent instead of 2 per cent.

The quality of the copper produced at Chuquicamata places it in the highest class of electrolytic copper.

The detailed metallurgical forecasts made by Mr. Smith during the time of the development of the process have been met to a remarkable degree by the plant in full operation. The cost naturally is higher than that forecasted before the war, but if allowance be made for increased cost of production due to changed world-wide conditions, I believe that Mr. Smith's predicted cost production has been fully met.

During the experimental stages there was, as there always is in progressive development of this sort, much shaking of heads by many doubting Thomases. There was doubt which varied from prediction of complete failure to prediction that Mr. Smith might partially achieve the so-called optimistic results which he prophesied. The temptation to discount, which is usually called being conservative, is very great. Mr. Smith's predictions which were called optimistic have been proven accurate, and the so-called conservative statements have been proven inaccurate.

In concluding, I wish to say that Mr. Smith has applied to the development of the Chuquicamata process rare attributes seldom found in combination; namely, scientific knowledge and creative genius, together with commercial sense and executive ability. When they are found so combined as they are in Mr. Smith, humanity through science and commerce progresses.

[The toastmaster then read a letter from an old associate of Mr. Smith in Baltimore, R. Brent Keyser, and called on Dr. Waldemar Lindgren, a countryman of Mr. Smith, "to do the final act."]

Waldemar Lindgren.—I rise with some trepidation, knowing that I am the last speaker on the list and knowing that what often happens to him happens to me; namely, that a considerable amount of my thunder has been stolen.

The speakers who have preceded me have told you, more fully and better than I could have done, of the purpose of this happy occasion, of the achievements of our honored guest, and why the Mining and Metallurgical Society of America wishes him to accept its Gold Medal for distinguished services to the art of hydrometallurgy. A geologist like myself is supposed to know but little of metallurgy but echoes of the doings of the smelting fraternity reach the workers in other branches of science. However, I will say that once in the dim and distant past I kept a lead furnace alive for three days under most adverse circumstances. With strict adherence to truth I shall confess that on the fourth day glacial chill invaded the inwards of that furnace.

As a student of ore deposits, I have seen Mother Nature apply her processes to the isolation of metals—and no mean hydrometallurgist is she. Like our friend here she likes to deal with sulphuric acid and she precipitates copper, gold and silver by the electric current as well as with reducing agents.

The first hydrometallurgist among humans appeared when the ancient miner dropped his implement of iron in the mine waters of a copper deposit and wonderingly beheld the result. From these days to the present there extends a long list of achievements and of honorable names. Some years ago I had the pleasure of seeing the Chuquicamata plant with the guidance of our friend, Mr. Cappelen Smith. It was an impressive sight indeed and it told so plainly its own wonderful story. A few days afterwards I saw the anthithesis to this plant, a few miles away, where a miner treated his ore, brought down in mule carts from the neighboring mountains. He dumped it in little cement tanks under the open sky in Calama Valley, leached it with water and precipitated with scrap iron. There was a contrast for you—a contrast between the old and the new, the small beginning, and the magnificent last word of engineering. And as I pondered over this I thought I could see the secret of the success of our friend, Smith, in his great undertaking. True he had behind him the bold enterprise of capital, the knowledge of preceding generations. But his success was a result of his own brain and personality. Of his chemistry and engineering others have spoken. I propose to say a few words about his personality.

To his genial and happy disposition all his friends can testify, but this admirable quality would not have carried him through alone. I think it was his optimism, his confidence and his perseverance. We all know that a miner should be an optimist. In fact, Mark Twain has suggested that he may carry it a little too far at times. It is certainly true that a metallurgist also needs this quality, especially when everything goes dead wrong, when the chlorides play havoc, when the oil fails to arrive, when the anodes—or is it cathodes?—go wrong. This optimism and perseverance were in evidence right along in the work of our friend: when the experiments were in progress among doubting Thomases, and as well under the manifold discouragements of construction in a hostile climate. These qualities not only carried him along but brought reflex action from his assistants and co-laborers. Every visit of Cappelen Smith to Chuquicamata, I am told, brought a rise in the percentage of extraction, and finally all the difficulties were overcome and the engineering enterprise brought to a triumphant conclusion.

Anton Elias Cappelen Smith, by the advancement of the art of hydrometallurgy and by the building of plants audacious in their conception, successful in their construction, you have notably contributed to the progress of our civilization. In recognition of your distinguished services, the Mining and Metallurgical Society of America now awards you its Gold Medal.

E. A. Cappelen Smith.—I am deeply touched by the honor that has been conferred upon me this evening and I wish to offer my sincere thanks to the Council and to the members of the Society for so generously recognizing the small amount which I may have contributed to the advancement of the art of hydrometallurgy. It will always be a source of keen gratification to me to feel that you have seen fit to place me among those whom you have previously honored with this gold medal.

When, on my return from Europe last spring, I heard rumors that my name was being considered for this honor, I was naturally very much gratified, but on second thought I could not help but say, "Are you sure they mean me and not some other Smith?" My apprehension was only natural, for experience has shown me that in this country there are many claimants for anything marked Smith. In Norway, where as you have heard, I was born, the name Smith is rather unusual. I remember my consternation when I first came to America and was asked as a joke, but sometimes even in earnest, "Now, really, what used to be your name in the old country?"

In the old days in Montana, not every one knew his geography nor the political history of the smaller nations of northern Europe. That may be the reason why they nicknamed me "Swede Smith." I have often had to apologize to my Swedish friends for sailing under false colors. I think the climax was reached, however, when one of the superintendents out there in speaking of me, said, "Go down to the refinery and see that young fellow Smith. You know, that Swede from Switzerland." It seems to me only fair that I should take this opportunity to publicly apologize to the Swiss.

My wife has warned me not to inflict upon you any of what she is pleased to call "tank talk about Chuquicamata." She says that nobody wants to hear any of that sort of stuff. I will at least consider the ladies who have been so kind as to attend this dinner. I daresay most of the wives of the engineers present have often had to listen and suffer from this same so-called "tank talk." I believe that many engineers have the same weakness—that of wanting to talk about their own work, and in this respect some of us, I am sorry to admit, take shameless advantage of the innocent and helpless. I remember, for instance, while on a visit to Norway some years ago there were a number of people present in my mother's home and I was expounding at great length the principles of the basic converter. One dear old lady who had been listening like a martyr for some time, finally said, "Did I hear you say converting?" I said, "Yes, converting of copper," whereupon her face fell and she disappointedly said, "Oh, I was thinking that converting might have something to do with religion."

You have heard a great deal tonight about Chuquicamata, but this solution of the Chuquicamata problem is not the result of any one man's wrok, but rather the united efforts of an enthusiastic and harmonious unit of engineers, organized and captained by Pope Yeatman, and backed by the confidence of the men whose financial support made the enterprise possible. Nothing could have been more inspiring than the faith and confidence which Daniel Guggenheim, and his brothers, and Mr. Burrage placed in their engineers, and this in the face of a great deal of adverse criticism by many of our brother engineers, who while conceding that Chuquicamata was a great mine were still doubtful about the outcome. One of the many reasons that they were doubtful was because the Guggenheims and Mr. Yeatman had placed an optimist in charge of the metallurgy.

For the benefit of those present who are not engineers, I wish to explain that optimism in an engineer is so undesirable that it almost amounts to a cardinal sin. I hope you will pardon me if I point out the lesson which I think the result at Chuquicamata teaches, and it is that carefully conducted experiments while on a small scale may be sufficiently reliable to refute that old saying which we are forever hearing, namely, "It is only a laboratory experiment and it probably will not work in practice."

As I listen tonight to all your kind remarks and see all these friendly faces around me, I repeat, I am deeply touched. I had no idea when I came here a stranger twenty-seven years ago that I should meet with so much kindness and generosity. But as a matter of fact I have met with nothing else, and not only that but it has been my great good fortune to be placed in positions where my work has been greatly facilitated by every kind of encouragement and advice. As one of those who have benefited, I realize, perhaps, more than most of you the wonderful spirit of this country, which cheerfully gives to the stranger coming to its shores, if he is willing to work, the same unlimited opportunity which it offers to its native sons.

Mr. President and members of the Society, I thank you again for this great honor and I accept it as an appreciation of work accomplished, not by my efforts alone, but by the efforts of the metallurgical organization of which I am only a member.

[Among the letters read at the dinner was one from Horace V. Winchell, expressing his regrets at being unable to be present, and extending congratulations to Mr. Smith.]

COMMUNICATION.

To the Secretary:

A National Public Works Department is in sight, but your help is still needed!

Your Society participated in a conference called by Engineering Council at Chicago in April, 1919, which resulted in the organization of the National Public Works Department Association. Engineering Council, on behalf of the engineering profession, has given much moral and financial support to this Association.

The movement which is now nearing fruition has interested the engineering profession for 35 years. The N. P. W. D. A., which was formed to prosecute this movement, has been quite successful. It has not only secured the general acceptance of the principle, but has also been largely responsible for the widespread demand that has arisen for thorough reorganization in all lines of departmental activity in the Government.

The Jones-Reavis bill, or its equivalent, creating a Department of Public Works, would now have been an accomplished fact but for the large amount of emergency legislation still pending in Congress, resulting from our participation in the World War.

This is the first occasion on which engineers have really got together on a large constructive piece of National legislative work. Unless we are to lose the benefit of efforts already made, we must have the continued earnest support of the engineering societies of the country and their individual members.

If engineers in civil life do not follow up this movement which has been instituted, they may suddenly find that it is being carried through for the advancement of others.

Congress reconvenes in December. Will you do your share by getting in touch with members of Congress and enlisting their support for this movement?

Yours very truly,

J. PARKE CHANNING,
Chairman, Engineering Council.

New York, Nov. 16, 1920.

Mining and Metallurgical Society *of* America

OFFICERS, MEMBERS AND COMMITTEES

June 1, 1921

115 Broadway, New York

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Executive Committee, Messrs. J. E. Spurr, W. Y. Westervelt, F. F. Sharpless, W. R. Ingalls and H. H. Knox.

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At large, ex-officio.

J. E. Spurr, New York	Retires January, 1922
W. Y. Westervelt, New York	Retires January, 1922
F. F. Sharpless, New York	Retires January, 1922
Waldemar Lindgren, Cambridge	Retires January, 1923

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W. R. Ingalls, New York	Retires January, 1922
H. H. Knox, New York	Retires January, 1923
J. Parke Channing, New York	Retires January, 1924
Pope Yeatman, New York	Retires January, 1924

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R. A. F. Penrose, Jr., Philadelphia	Retires January, 1922

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F. G. Cottrell, Washington, D. C.	Retires January, 1923

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H. V. Winchell, Minneapolis	Retires January, 1923

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Richard A. Parker, Denver	Retires January, 1924

Districts 9-10—Northern California, Nevada, and Alaska.

Albert Burch, San Francisco	Retires January, 1923
W. J. Loring, San Francisco	Retires January, 1924

District 11—Southern California, Arizona, and Texas.

Ralph Arnold, Los Angeles	Retires January, 1922

District 12—Washington, Idaho, Oregon, Montana, and Western Canada.

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JUNE 1, 1921

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Adkinson, Henry M.........Walker Bank Bldg., Salt Lake City, Utah
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Asso. Editor, Mining & Scientific Press.

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Cons. Engineer.

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General Manager.

Argall, Philip..................728 U. S. National Bk. Bldg., Denver, Colo.
Consulting Mining and Metallurgical Engineer.

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Consulting Geologist and Engineer.

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Consulting Metallurgist.

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Mine Superintendent.

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Manager, Ray Consolidated Copper Co.

Bradley, F. W....................Crocker Bldg., San Francisco, Cal.
Pres., Bunker Hill & Sullivan M. & C. Co.

Bradley, P. R..................................Treadwell, Alaska
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Bradshaw, Frederick...........917 Hobart Bldg., San Francisco, Cal.
Mine Manager.

Brayton, Corey C.....................2717 Webster Ave., Berkeley, Cal.
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